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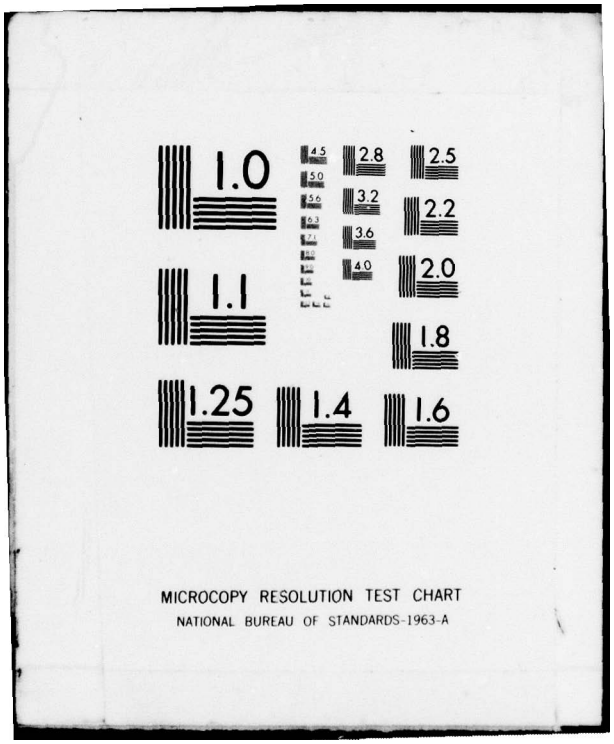
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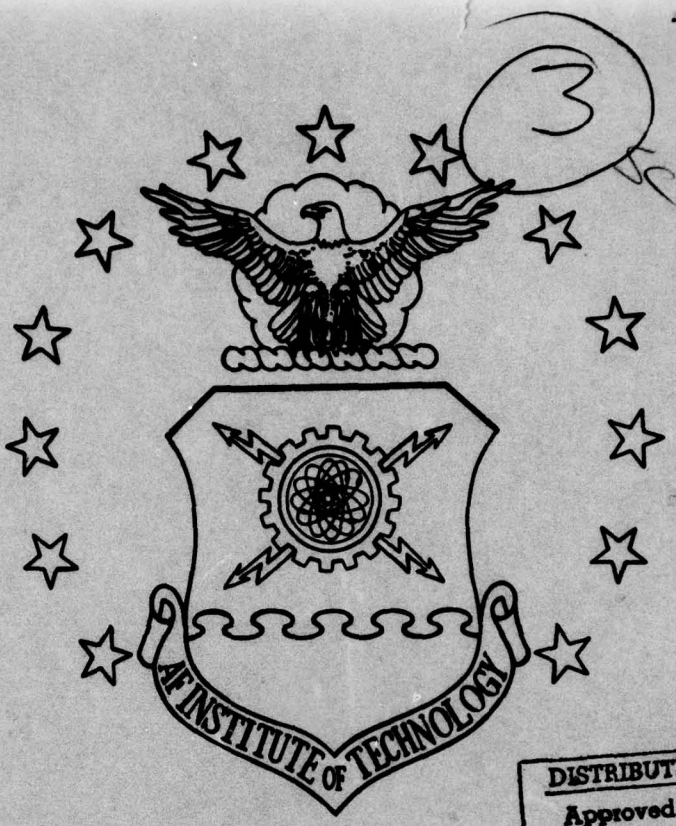

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(10) Daniel V. Connors, Major, USAF
Dennis M. Maloney, Captain, USAF

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This research attempted to analyze and integrate the work of several previous thesis teams into a definitive model which will explain the causal relationships among nine organizational variables (program phase, organization size, tenure, level of bureaucracy, organizational climate, role conflict, role ambiguity, role stress, and conflict intensity) as the Air Force System Program Office progresses through its life cycle. The statistical technique to be employed was cross-lagged analysis, a technique designed for use in longitudinal research. However, upon examination of the raw data provided by each team, they were found to be incompatible for use in cross-lagged analysis. The research effort was then altered to (1) adapt the data to a form useable in cross-lagged analysis, (2) demonstrate the use of the technique in analyzing organization variables, and (3) delineate required events for the successful use of cross-lagged analysis in the study of the variables in question. Findings included (1) minor support for selected relationships in an earlier hypothesized model, and (2) the cross-lagged analysis technique can be used in this area of study once the data to be used is compatible. Additional research using this technique is strongly recommended.

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ORGANIZATIONAL CHANGE PATTERNS IN THE AIR FORCE SYSTEM PROGRAM OFFICE

A Thesis

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Logistics Management

By

Daniel V. Connors, BS
Major, USAF

Dennis M. Maloney, BA
Captain, USAF

June 1979

This thesis, written by

Major Daniel V. Connors

and

Captain Dennis M. Maloney

has been accepted by the undersigned on behalf of the faculty of the School of Systems and Logistics in partial fulfillment of the requirements for the degrees of

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(Major Daniel V. Connors)

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(Captain Dennis M. Maloney)

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Lt. Col. John R. Adams, USAF
COMMITTEE CHAIRMAN

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Chapter 1

INTRODUCTION

The United States Air Force is currently involved in the acquisition of weapon systems costing billions of dollars. The complexity of these systems and their high and rapidly growing costs justify placing considerable emphasis on the acquisition process itself to ensure a quality commensurate with that cost (7:76-77). Consequently, a great deal of Air Force effort is expended in studying the organizational concepts used to acquire such systems. The Department of Defense and the Air Force use the techniques of program/project management to control this dynamic process.

The particular organizational structure selected by the Air Force to implement this concept is the System Program Office (SPO). In theory, the organization of a SPO, like most organizations, is systems oriented and is affected by many behavioral factors. It is both challenging and very difficult for a program manager to control his project, the office, and the acquisition process he is involved with. This research is an attempt to aid the program manager in this endeavor.

STATEMENT OF THE PROBLEM

Considerable research has been conducted in the past three to four years investigating key variables affecting the management environment of the SPO as it changes over its life cycle (5, 10, 16, 17, 20). These studies have investigated selected organizational variables at various points in time, drawing conclusions from statistical methods such as correlation analysis, one-way analysis of variance, and path analysis. Currently, however, the causal relationships among the major variables as they interact throughout the SPO's life cycle are not well understood. Longitudinal research is required to integrate the results of the prior investigations into a cohesive theory of causal relationships in a SPO's life cycle.

BACKGROUND OF THE PROBLEM

Several major organizational variables have been studied in the previous research efforts. These include organizational size, project manager tenure, level of bureaucracy, organizational climate, role ambiguity, role conflict, role stress, and conflict intensity. These particular organizational variables are identified by most organization theorists as likely to be the dominant variables in any organization's structure (3, 9, 12, 14, 18, 21).

The previous research efforts were accomplished in 1976, 1977 and 1978. The first three theses concentrated their study on certain variables among the group listed above while the last thesis from which data will be used studied all the variables in question. Each variable will be discussed in detail in Chapter 2, the literature review, but a brief description of the thrust of the various theses is warranted here.

Larson and Ruppert concentrated their efforts on organizational climate or the sum of all the different perceptions the individuals in an organization have with respect to their organization. In their study they attempted to measure and assess the prevailing organizational climate in SPO's in different stages of the weapon system acquisition process. Their analysis of data collected revealed that there is a significant change in perceived organizational climate as the SPO is formed and moves through its life cycle (16:ia).

Lempke and Mann were next to make their contribution to this overall research effort. Their study looked at the possible relationship between a program manager's tenure and the changes in the organizational nature of the tasks he performs. They also attempted to relate tenure and the level of bureaucracy in the SPO to the program manager's perceived role stress, which is the sum of role conflict and role ambiguity (17:ia).

The next to make a contribution in the overall research plan was the team of Haddox and Long. Their purpose was to determine whether certain organizational variables would affect job satisfaction and perception of organizational climate among managers in SPO's. They provided valuable information on the variables or organizational climate, tenure, and organizational size, and how these variables were affected by or affected the life cycle of the SPO (10:ia).

Eschmann and Lee analyzed the conflict environment in the Air Force SPO. In attempting to compare the conflict faced by Air Force program managers with that experienced by civilian counterparts, they uncovered significant relationships between conflict and the different phases in the life cycle of the SPO (5:ia).

Noyes and Parker made a key contribution to the overall research effort on the management environment in an Air Force SPO. In their research effort they sought to synthesize all prior findings concerning the organizational variables in question and provide a more comprehensive perspective of program organizations as they progress through the project life cycle. In addition, they collected a new set of data coordinated across all the variables discussed and added new information on the relationships which exist among these variables (20:12).

The proposed research effort analyzes all data collected to date and attempts to establish definitive relationships among the organizational variables.

JUSTIFICATION

As stated previously, this research effort is one phase in an ongoing study of the management environment of Air Force SPO's. The justification and value of prior studies remains valid. The tremendous amounts of money program managers are responsible for, and the continuing trends in cost overruns, contract claims, contested awards, buy-ins, defective systems, and lack of visibility for program actions, demand that greater emphasis be placed on the management of the acquisition process (8:2).

Considerable attention has been directed toward improving the productivity of SPO organizations. Noyes and Parker defined productivity as a means of how well resources are brought together in organizations to accomplish a set of results and reaching the highest level of performance with the least expenditure of resources. In other words, productivity combines the concepts of effectiveness (achievement of desired results) and efficiency (minimum resource consumption) (20:8).

Considering the amount of money that could be saved by improving the manner in which weapon systems are procured, it is imperative that the program manager be aware of

any variables and their relationships that affect the structure of his organization and its productivity. This research, combined with the prior studies, will provide greater insight into the complexities of program/project management and will help determine how to organize for increased effectiveness.

RESEARCH OBJECTIVE

The objective of this research is to analyze and integrate the work of several previous theses teams into a definitive model which will explain the causal relationships among major organizational variables as the System Program Office (SPO) progresses through its life cycle.

This objective will be pursued in two steps:

1. Perform longitudinal analysis designed to examine major organizational variables as they change throughout the weapon system acquisition process.

2. Construct a model to explain the causal relationships among the variables using information gathered at two separate points in time.

RESEARCH QUESTION

1. Can the previous research efforts cited be integrated into an overall causal model of the life cycle of a System Program Office?

a. Are the results of previous efforts sufficiently compatible to allow integration?

b. Is a procedure available to accomplish integration?

c. Can a realistic or appropriate theory be developed from this model once constructed?

SCOPE

The data used in this study was gathered from the System Program Offices within the Air Force Systems Command's Aeronautical Systems Division at Wright-Patterson Air Force Base, Ohio. The data were collected at basically two different points in time but were measures of identical variables. No new data will be collected during this study.

Chapter 2

LITERATURE REVIEW

INTRODUCTION

This chapter provides background information on the nine individual areas investigated by this study. The nine areas discussed are the weapon system acquisition process, organizational size, tenure, level of bureaucracy, organizational climate, role conflict, role ambiguity, role stress, and conflict intensity. Relationships within each of these individual areas and the other organizational variables investigated are discussed where the relationships have been established in the literature. The chapter closes with a diagram highlighting the relationships of the variables implied in the literature.

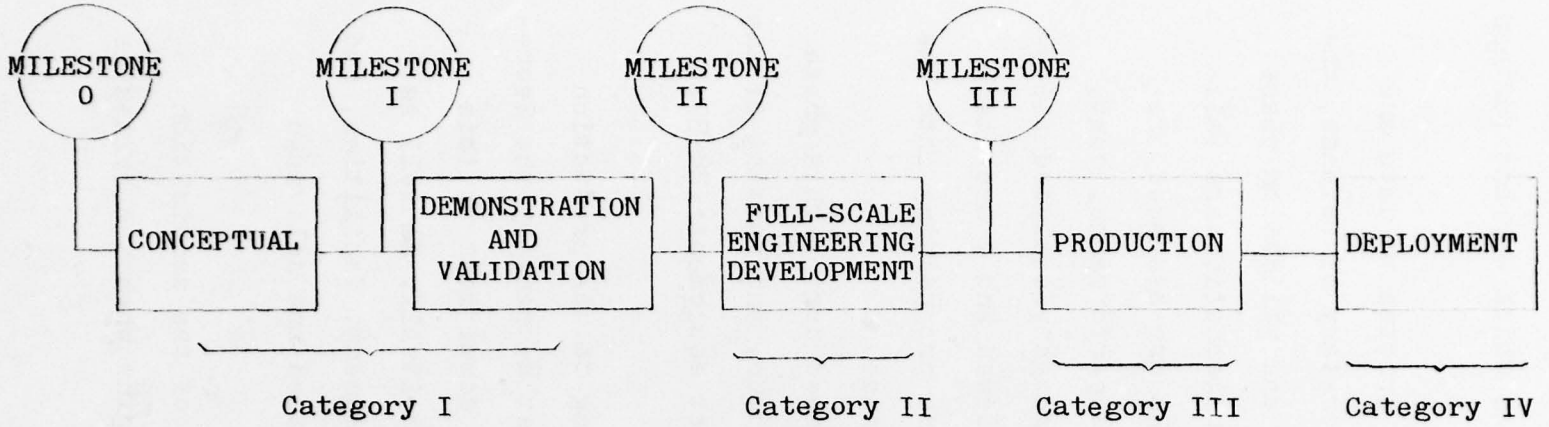
THE WEAPON SYSTEM ACQUISITION PROCESS

The technology required to develop major new systems has become increasingly more diverse and more complex since the Air Force has been in existence. This increasing diversity and complexity has led to extensive innovation in management systems, resulting in the application of even more complex project management techniques to most major advanced-technology efforts (1). The process this

management technique is applied to is termed the Weapon System Acquisition Process (WSAP).

The WSAP is divided into five major phases which are distinguished from each other by the unique objectives and task characteristics of each phase (20:15-16). These phases are termed: (1) conceptual, (2) demonstration and validation, (3) full-scale engineering development, (4) production, and (5) deployment (Figure 1). These phases are separated from each other by required program continuation decisions (milestones) that are made by the Defense System Acquisition Review Council (DSARC) and ratified by the Secretary of Defense (29:3). The decision points have been labelled Milestones 0, I, II, and III (29:3-4). A continuing analysis of existing capabilities is being made by all DOD Agencies, and when a need is detected a Mission Element Need Statement (MENS) is prepared and submitted to the Secretary of Defense. The MENS discusses the mission purpose, capability, agencies involved, time constraints, relative priority, and operating constraints, and is <u>not</u> to be expressed in terms of equipment or other material means which might satisfy the need (30:7).

a) A favorable decision at this Milestone 0 begins the acquisition process in the conceptual phase (29:3). At this time the program manager is appointed; the technical, military, and economic bases from which the weapon system will be developed are established; the management approach



Conceptual Phase:	Technical, military, and economic bases are established, and the management approach and acquisition strategy are delineated.
Demonstration and Validation Phase:	Major program characteristics are validated and refined, program risks assessed, resolved or minimized.
Full-Scale Engineering Development Phase:	Design, fabrication, and test are completed.
Production Phase:	The system is efficiently produced and delivered as an effective supportable system.
Deployment Phase:	The system reaches its operational ready state and is turned over to the using command and transitioned to AFLC.

Figure 1. Phases of the Acquisition Process (28:37).

and acquisition strategy are delineated; and identification and selection of those system concepts which warrant further efforts is made (28:37;16:6,7).

b) Following a review of the process to date and another favorable decision by the Secretary of Defense, the program moves into the demonstration and validation phase. During this phase major program characteristics are validated and refined, while program risks are assessed, resolved or minimized. Factors such as performance, cost, and schedule characteristics are thoroughly analyzed (16:9-10;28:37). Again the program is reviewed and a Secretary of Defense decision is required before progressing into the full-scale engineering development phase.

c) The tasks that are approached during this phase are the design, fabrication, integration, and testing of the weapon system and all required support equipment (28:37; 16:12).

d) Once again, prior to moving to the production phase, another favorable decision must be made by the Secretary of Defense. This decision is a commitment to this particular weapon system. The system itself, as well as such factors as spares, training equipment, facilities, and Aerospace Ground Equipment, are produced and delivered (28:37;16:14).

e) Entry into the last phase of the acquisition process requires no decision. It begins when the system is

delivered and accepted at the operational unit and does not end until the system is phased out of the inventory.

For the program manager, however, the WSAP ends when responsibility for support of the system is transferred to the Air Force Logistics Command (AFLC) (16:16). To remain consistent with all prior studies, the five phases of the weapon system acquisition process will be categorized to match the four life cycle stages of a civilian project/program (Table 1).

ORGANIZATION SIZE

The size of the System Program Office (SPO) changes as it moves through the Weapon System Acquisition Process paralleling the changes in the tasks required to be performed. The SPO tends to be relatively small in the early and late phases and much larger in the middle phases (1). This change in size presents a range of problems for the organization and becomes a determinant of both structural and behavior variables (20:19). "Increased size may dictate more links in the scalar chain, requiring greater formalization of communication and reporting systems [1]." Research has demonstrated a strong correlation between size and the structuring of activities which included standardization of functions, formalization of processes, and specialization of roles (20:21). Pugh, Hickson, Hinings, and Turner said:

Table 1

CATEGORIZATION OF PROGRAM LIFE-CYCLE PHASES (2:20)

Categories for Study	"Military" Life-Cycle Phases	"Civilian" Life-Cycle Stages	Activities Involved
I	Conceptual/ Validation	Formation	1. Identify need 2. Establish feasibility 3. Prepare proposal 4. Program characteristics validated and refined 5. Program personnel identified and scheduled
II	Full-Scale Development	Buildup	1. Design system 2. Build and test prototype models 3. Approval for final production
III	Production	Main Program	1. System production 2. Logistical support activities implemented 3. Performance verified during transition to the field
IV	Deployment	Phasedown	1. Other agencies assume responsibility for new product 2. Program effort decreases and disbands 3. Personnel reassigned

> An increasing scale of operations increases the frequency of recurring events and the repetition of decisions, which are then standardized and formalized . . . . Once the number of positions and people grow beyond control by personal interaction, the organization must be more explicitly structured [23:112].

As the size increases the SPO tends to become more formalized and of necessity the SPO Director must exert controls which were not required when the organization was small. This change in size has an effect on all other variables affecting the organization (1).

TENURE

Personnel turnover in organizations has been studied and reported on at great length (21:111, 216-217;20:22-24; 17:27-34). A major problem identified with frequent turnover of personnel in a program environment relates to program continuity (20:23). Porter, et al., stated that:

> . . . most organizations are purposely designed in such a way as to anticipate and take into account the fact that membership will be changing . . . . The organization thus attempts to preserve its own continuity by fostering the substitutability of its members . . . organizations are often able to achieve only partial or limited substitutability. Hence, the organization's continuity is made more dependent upon the continuity of membership of a particular individual . . . to the extent that particular members contribute unique and highly needed personal resources (ideas, experience, abilities, etc.) [21:97].

The Department of Defense recognized this problem of tenure and continuity in program management when it stated

in its policy guidance on Major System Acquisition that:

> . . . assignment and tenure of a program manager shall be of concern to the DOD Component Head. Career incentives shall be established to attract, retain, motivate and reward competent program managers. A change in program managers shall not be made prior to Milestone I or during full-scale engineering development prior to Milestone III decision . . . changes in program managers shall be held to a *minimum* and overlap between the two managers should be provided during the transition [29:5].

Another observation made by Kahn, et al., concerning tenure was that as tenure among managers increased, those managers tend to profess greater adherence to rules and procedures. Further, they tend to support formal organization rules over personal, informal rules (14:158-160). These premises could be extended to include the actions of a program manager, and may help explain some differences that occur across program phases when and as tenure increases.

LEVEL OF BUREAUCRACY

The level of bureaucracy can best be described as a continuum ranging from a mechanistic (bureaucratic) structure at one end to an organistic (systemic) structure at the other. Other names have also been used in various articles and publications to describe this continuum, such as closed system versus open system, stable versus adaptive, organizational structure, and functional versus project organizations (3:229-232;14:507-509).

Cleland and King adopted functional versus project as the endpoint considerations available to program managers. Table 2 displays the functional versus project viewpoints of organizational structure. The table highlights the structured environment of the functional manager whereby responsibility is defined, line-staff relations are established, and a chain-of-command directs the operation (20: 26-27).

Adams and Barndt adopted mechanistic versus organistic as their terms for the endpoint considerations available to program managers:

> Mechanistic structure refers to an organization with communication directed primarily downward, high formalization of rules and procedures, adherence to the chain-of-command, low intergroup cooperation, and infrequent task feedback. An organistic structure is characterized by high intergroup cooperation, frequent task feedback, open communication channels, low formalization of rules and procedures, and a lack of adherence to the chain-of-command [1].

The organistic characteristics stated above are also characteristic of a project organization as shown in Table 2.

Although a review of the published literature was conducted, no recognized measuring tool was found that could measure and define a manager's job as being project or functionally oriented. However, Lempke and Mann developed a measuring tool structured around the differences of functional and project organizations identified by Cleland and King (20:29). The level of bureaucracy was measured

Table 2

COMPARISON OF THE FUNCTIONAL AND
THE PROJECT VIEWPOINTS

PHENOMENA	PROJECT VIEWPOINT	FUNCTIONAL VIEWPOINT
Line-staff organizational dichotomy	Vestiges of the hierarchical model remain, the line functions are placed in a support position. A web of authority and responsibility relationships exists.	Line functions have direct responsibility for accomplishing the objectives; line commands, and staff advises.
Scalar principle	Elements of the vertical chain exist, but prime emphasis is placed on horizontal and diagonal work flow. Important business is conducted as the legitimacy of the task requires.	The chain of authority relationships is from superior to subordinate throughout the organization. Central, crucial, and important business is conducted up and down the vertical hierarchy.
Superior-subordinate relationship	Peer-to-peer, manager-to-technical-expert, associate-to-associate, etc., relationships are used to conduct much of the salient business.	This is the most important relationship; if kept healthy, success will follow. All important business is conducted through a pyramiding structure of superiors and subordinates.

PHENOMENA	PROJECT VIEWPOINT	FUNCTIONAL VIEWPOINT
Organizational objectives	Management of a project becomes a joint venture of many relatively independent organizations. Thus, the objective becomes multilateral.	Organizational objectives are sought by the parent unit (an assembly of suborganizations) working within its environment. The objective is unilateral.
Unity of direction	The project manager manages across functional and organizational lines to accomplish a common interorganizational objective.	The general manager acts as the one head for a group of activities having the same plan.
Parity of authority and responsibility	Considerable opportunity exists for the project manager's responsibility to exceed his authority. Support people are often responsible to other managers (functional) for pay, performance reports, promotions, etc.	Consistent with functional management; the integrity of the superior-subordinate relationship is maintained through functional authority and advisory staff services.
Time duration	The project (and hence the organization) is finite in duration.	Tends to perpetuate itself to provide continuing facilitative support.

*Source: David I. Cleland and William R. King. Systems Analysis and Project Management. New York: McGraw-Hill, 1968, p. 153.

using a number of specifically designed questions given to the managers of program offices in the Air Force's Aeronautical Systems Division ranging in size from approximately five individuals to an office of more than 200 (17:4-9).

Lempke and Mann concluded that the Systems Program Office tends to be organistic (project) oriented in the initial phases of the acquisition cycle. However, as the acquisition cycle progressed the Systems Program Office increased in size as the tasks changed, and with the increase in size the organization became more mechanistic (functionally) oriented. As the acquisition system aged into the latter phases of its life cycle, the Systems Program Office reverted back toward an organistic (project) oriented organization (17:9-10).

These differences can be attributed to the changes in size of the organization, the changing nature of the tasks being performed, and in some cases to the changing tenure of the project manager and his ability to functionalize tasks and to formalize communications. Changes in the level of bureaucracy may also have an impact on organizational climate, the employees' perceptions of the work environment within the organization (20:29).

ORGANIZATIONAL CLIMATE

"This concept of organizational climate is undoubtedly important, but it also seems to be one of the fuzziest

concepts to come along in a long time [9:121]." This quote from Guion's "A Note on Organizational Climate" gives us some idea of the ambiguity of organizational climate and the variances in its definition. Hellriegel and Slocum defined it as:

> . . . a set of attitudes which can be perceived about a particular organization and/or its subsystems, and that may be induced from the way that organizations and/or its subsystems deal with their members and environments [12:256].

Litwin and Stringer defined it as:

> . . . a set of measurable properties of the work environment, perceived directly or indirectly by the people who live and work in this environment and assumed to influence their motivation and behavior [18:1].

Pritchard and Karasick described it as:

> . . . a relatively enduring quality of an organization's internal environment distinguishing it from other organizations; (a) which results from the behavior and policies of members of the organization, especially top management; (b) which is perceived by members of the organization; (c) which serves as a basis for interpreting the situation; and (d) acts as a source of pressure for directing activity [22:126].

Common throughout these definitions is the behavioral aspect of perception. Litwin and Stringer have outlined a subjective model which views "perceived organizational climate" as a filter through which objective phenomena pass (10:3). This model is illustrated in Figure 2. All in all, organizational climate seems to provide a conceptual link between the organizational system and the

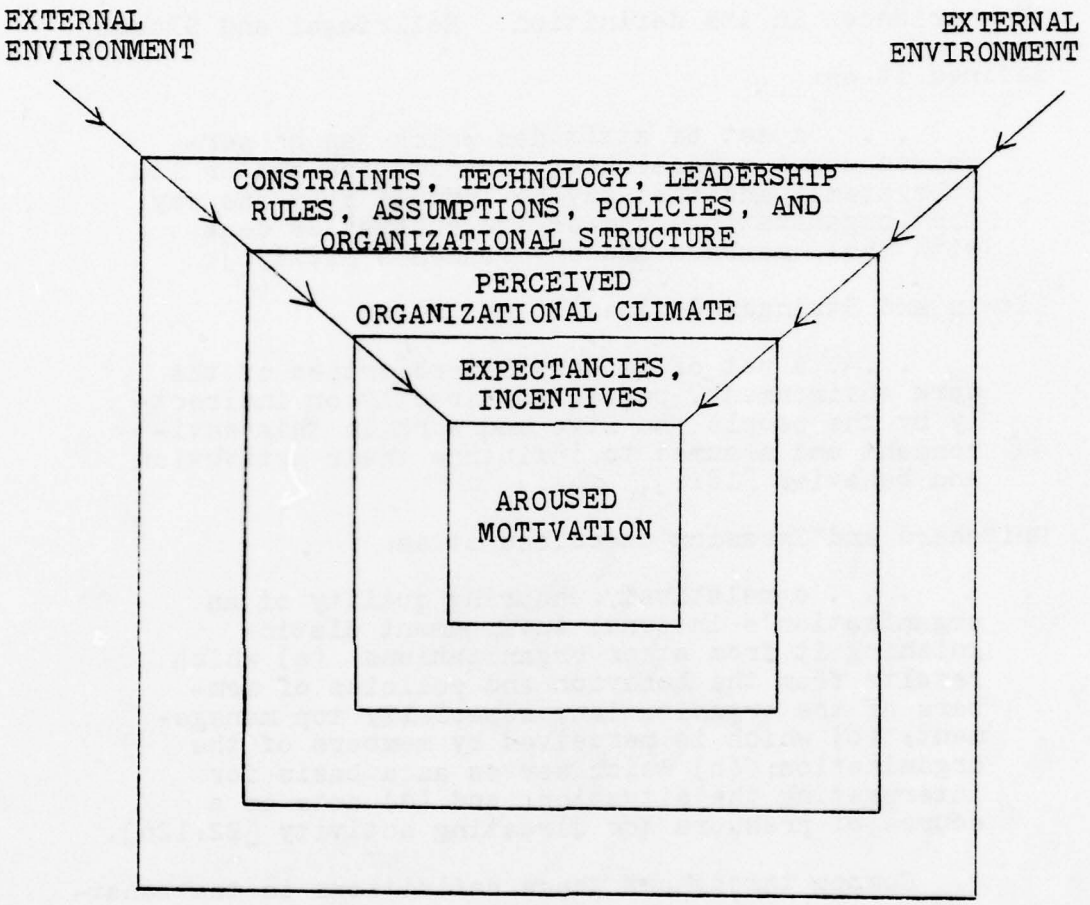


Figure 2. Model of the Determinants of Motivated Behavior in Organizations (18:43).

determinants of individual behavior. It also provides a link for the manager between organizational procedures and the needs of workers (10:5).

ROLE CONFLICT

In a matrix organization such as the System Program Office, it is a natural occurrence for role conflict to arise. This conflict may vary through the phases of the Weapon System Acquisition Process. In fact, as the nature of a program manager's tasks become more project oriented, his perceived level of role conflict should be expected to increase (17:35).

Role conflict can be defined as ". . . the simultaneous occurrence of two [or more] sets of pressures such that compliance with one would make more difficult compliance with the other [14:19]." Kahn, et al., have identified a boundary position concept which states that persons in positions that require them to interface with organizations or sub-organizations outside of their own tend to experience high levels of role conflict (14:101). The program manager, as the focal point within the SPO, has broad responsibility but possesses no real authority over other participating organizations that supply vital support to his project (17:18-19). The interface that he must accomplish with these participating units can, and usually does, lead to role conflict. As the structure and climate of the

organization change with the phases of the acquisition process this role conflict can vary both in terms of its source and its intensity.

ROLE AMBIGUITY

Role ambiguity has been defined as ". . . the lack of the necessary information available to a given organizational position [24:151]." Confusion and ambiguity are common conditions when jobs are not clearly defined, supervisor and subordinate relationships are vague, and lines of communication are disorganized (5:17).

According to classical organization theory, each position within the organizational structure should receive information in sufficient quantities to perform required tasks. However, when this information flow fails, an occurrence which is likely to occur in a dynamic (ever-changing) environment, role theory states that anxiety and tension will exist (24:151).

Project management is one such situation where tasks are seldom completely defined or understood and information flows may be intermittent during the early stages of the weapon acquisition system (17:26). Assigned team members may feel that they don't know who their real boss is, or they don't know who they should try to please and impress for their evaluation reports, or worse they may receive the nonverbal feedback that their boss doesn't know what's

going on or what should be done. This can be a frustrating situation for some people, and can lead to high levels of stress.

Lempke and Mann mentioned that as a program manager gained tenure in a project, he tended to work towards reducing the ambiguities of his co-workers by defining and stabilizing his formal and informal information network (17:26). He also tended to profess adherence to established rules and procedures, and hence functionalized subordinates tasks over time. Note that establishing communication systems and adhering to rules and procedures tend to be determining factors of organizational climate (20:37).

In summary, although role conflict and role ambiguity are different, their effects within an organization may be very similar. Recognizing these similarities, Kahn (14:35) conceived a new term that expresses the combination of role conflict and role ambiguity as they exist within an organization. This term is role stress.

ROLE STRESS

Role stress is a term designed to collectively address the combined effects of role conflict and role ambiguity. Role stress is defined as the sum of role conflict and role ambiguity, given the assumption that both variables are independent. However, Kahn has indicated that

being able to cope with one of the variables of role stress will not necessarily reduce role stress if the other factor is very strong (14:54).

Research on role stress in the Air Force System Program Office was conducted by Lempke and Mann using a measurement tool developed by Rizzo, House, and Lirtzman (24). Lempke and Mann discovered that the program manager is vulnerable to role stress in that as his tasks become increasingly more project oriented, his perceived level of role stress increases (17:27). They also discovered that the longer a program manager remains in the job, the more he can functionalize tasks. They could not find, however, any statistically significant relationship between time in the job and role stress. They did imply that the ability to functionalize tasks did seem to reduce the level of role ambiguity (17:88).

CONFLICT INTENSITY

The final variable being investigated is conflict intensity. This variable is best summed up by Walton and Dutton:

> Conflict potential exists when two units depend upon a common pool of scarce organizational resources, such as physical space, equipment, manpower, operating funds, capital funds, central staff resources, and centralized services [31:7].

This variable is not to be confused with "role conflict". Role conflict stresses behavior perceptions whereas conflict

intensity stresses conflict within the organizational structure.

Wilemon identified seven possible sources of conflict shown in Table 3 (26:32-33). The researchers, in testing and evaluating over one-hundred technology-oriented firms (including aerospace, computer, and research and development organizations), found that conflict intensity is greatest during the project buildup phase and least during the final stage of the life cycle (27:38).

Using the same basic evaluation instrument, Eschmann and Lee replicated the basic findings of Thamhain and Wilemon when they evaluated the Air Force System Program Offices. Eschmann and Lee found that the overall intensity of conflict decreases as a project progresses through the various phases of its life cycle (5:34).

RELATIONSHIPS AMONG THE ORGANIZATIONAL VARIABLES

The preceding discussion on the weapon system acquisition process, tenure, organizational size, level of bureaucracy, organizational climate, role conflict, role ambiguity, role stress, and conflict intensity reviewed previously researched and expressed relationships. Those findings suggest that a cause and effect relationship may exist among the above mentioned organizational variables (20:42). Figure 3 is a diagram depicting the basic pattern of role relationships which became the hypothesized model

Table 3

THE SEVEN SOURCES OF CONFLICT

Conflict over Project Priorities. The views of project participants often differ over the sequence of activities and tasks which should be undertaken to achieve successful project completion. Conflict over priorities may occur not only between the project team and other support groups but also within the project team.

Conflict over Administrative Procedures. A number of managerial and administrative-oriented conflicts may develop over how the project will be managed; i.e., the definition of the project manager's reporting relationships, definition of responsibilities, interface relationships, project scope, operational requirements, plan of execution, negotiated work agreements with other groups, and procedures for administrative support.

Conflict over Technical Opinions and Performance Tradeoffs. In technology-oriented projects, disagreements may arise over technical issues, performance specifications, technical tradeoffs, and the means to achieve performance.

Conflict over Manpower Resources. Conflicts may arise around the staffing of the project team with personnel from other functional and staff support areas or from the desire to use another department's personnel for project support even though the personnel remain under the authority of their functional or staff superiors.

Conflict over Cost. Frequently, conflict may develop over cost estimates from support areas regarding various project work breakdown packages. For example, the funds allocated by a project manager to a functional support group might be perceived as insufficient for the support requested.

Conflict over schedules. Disagreements may develop around the timing, sequencing, and scheduling of project related tasks.

Personality Conflict. Disagreements may tend to center on interpersonal differences rather than on "technical" issues. Conflicts often are "ego centered."

(26:32-33)

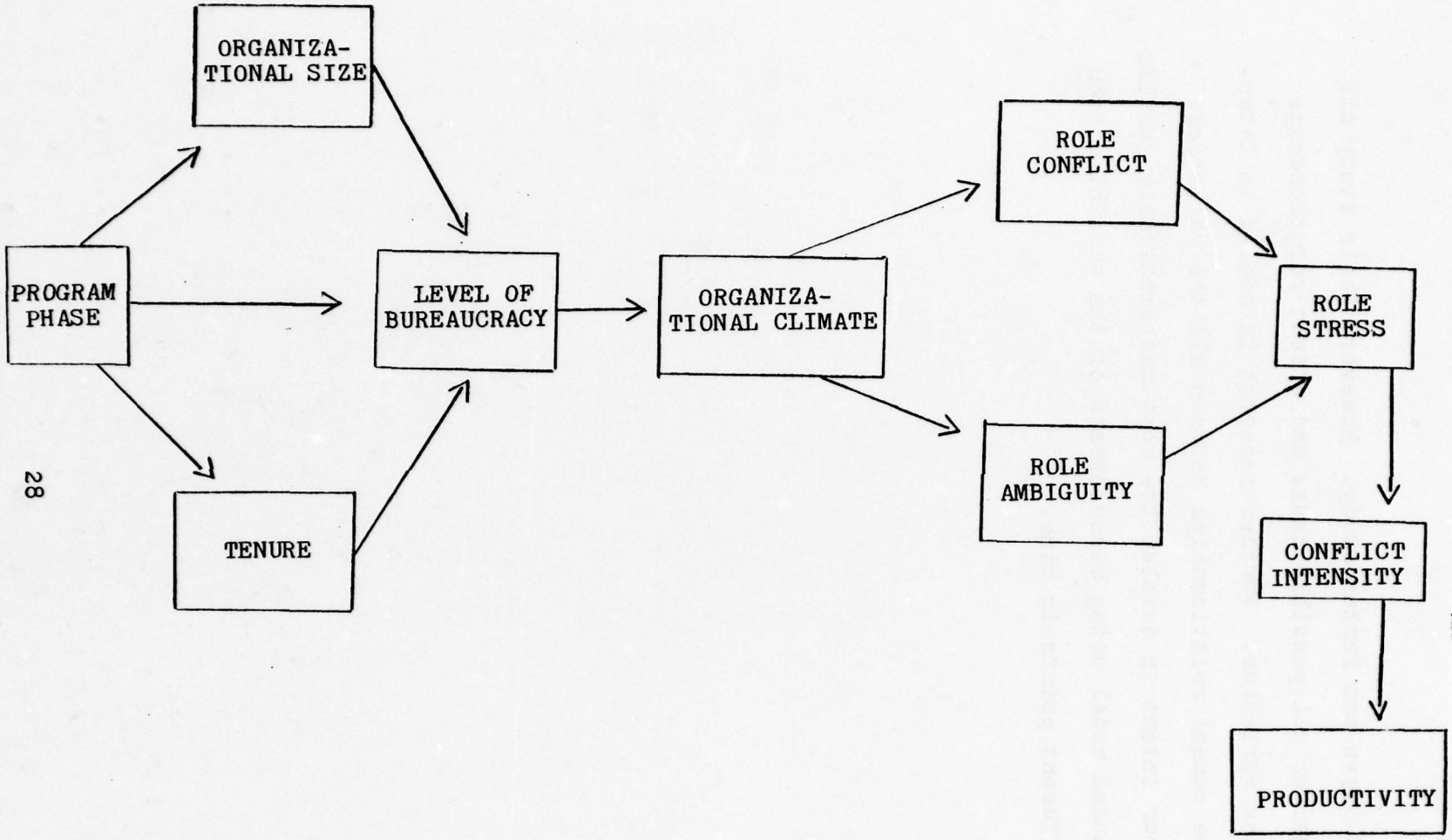


Figure 3. Relationships Among Organizational Variables (20:43).

for the Noyes and Parker study. However, their study did not consider all possible cause and effect relationships among the variables. Further research is needed to determine the causal relationships between all the variables. It is our intent to develop the most mathematically justifiable causal model using measurements of the variables from two different points in time.

Chapter 3

RESEARCH DESIGN AND METHODOLOGY

INTRODUCTION

This research effort is part of an ongoing research study of behavioral factors within System Program Offices (SPOs), involving more specifically those located at the Aeronautical System Division (ASD) of the Air Force Systems Command (AFSC). Therefore, the various methodology conventions established in previous research studies will be used so that this research study can contribute to the ongoing study (20). Appendix A contains a table summarizing the previous five research efforts in the project.

UNIVERSE

The universe consists of all SPO officers and civilians in the grade of Second Lieutenant or GS-7 respectively, and above, that were directly involved in managing Air Force weapon system acquisition programs within the United States Air Force (17:37). Those other managers in a SPO associated with strictly administrative and functional support type jobs are excluded (20:45).

POPULATION OF INTEREST

The population of interest in this study is limited to SPO managers within the Aeronautical Systems Division of the Air Force Systems Command (20:45-46). This command and constituent SPOs are located at Wright-Patterson AFB, Ohio. The sample-producing population is limited to program managers in SPOs that could be classified as being dedicated to one specific weapon system and also identified as being in a single phase of the weapon system acquisition process, as depicted in Figure 1 (20:46).

Assumptions used in this research effort concerning the validity of the sample results as applied to all other Air Force program managers must be the same as the assumptions used by the other research teams. These assumptions are best stated by the research team of Lempke and Mann:

> Because the population was necessarily limited, the data producing sample of program managers is a sample of convenience. However, common policies and regulations in AFSC govern the selection of program managers throughout the command. Additionally, the military members of the population share a variety of common experiences, including professional education, military training, and a multitude of military socializing influences. The results of this study may be applied to the broader population [17:37].

SELECTION OF SAMPLE

All the research teams identified in Appendix A stratified the SPOs into <u>at least</u> three life-cycle

categories except the team of Noyes and Parker, who used the four categories identified in Figure 1 (20:47). The only difference was the combining of the production and development phases as Category III due to their overlapping nature (10:15). Most of the research teams felt that it was extremely difficult to state with absolute certainty whether an individual SPO was operating in the production phase or in the deployment phase of the Weapon System Acquisition Cycle. However, Noyes and Parker defined the break point between the two phases as being when the first unit became operational then the deployment phase was reached (20:16).

A complete listing of program managers assigned to each SPO in the population was obtained from the individual SPOs. The listings were screened to insure that those individuals not meeting the definition of a SPO manager were eliminated. The remaining individuals were assigned a unique number for purposes of sample selection and control (20:47). A random number table was then used to select a sample of fifty SPO managers for each program life-cycle phase (with the exception of the Haddox-Long and the Larson-Ruppert studies, which used only thirty SPO managers in Category I) (10:16; 16:26).

DATA COLLECTION METHOD

Once the sample was determined, questionnaires used to collect the data were handcarried or mailed to each SPO

where they were then distributed to the managers identified in the sample. Sample members were asked to complete the questionnaires within a specified time and return them by way of the inter-office administrative mail system on Wright-Patterson Air Force Base. Pre-addressed envelopes were provided to expedite the return mailing process. This closed system of questionnaire transmittal and return gave the respondents a convenient method of completing and returning the questionnaires (16:26). The response rate values for the five previous research efforts were high and can be found in Appendix A.

DATA COLLECTION INSTRUMENT/VARIABLES

Appendix B contains the complete questionnaire used by Noyes and Parker. This questionnaire is a combination of three separate measuring instruments used by the other research teams to collect sample data on their variables of study, Table 4. Those segments from the different instruments were incorporated by Noyes and Parker specifically to insure that the variables common to the prior studies and their research effort would be measured consistent with the preceding efforts (20:49-50). Each portion of the questionnaire addressed a specific variable, and all the variables studied will be further examined in this thesis.

Table 4

VARIABLES AND RESEARCH TEAMS

	Lempke and Mann 1976	Haddox and Long 1976	Larson and Ruppert 1977	Eschmann and Lee 1977	Noyes and Parker 1978
Program Phase	X	X	X	X	X
Organizational Size		X			X
Tenure	X	X			X
Level of Bureaucracy	X	X	X		X
Organizational Climate		X	X		X
Role Conflict	X				X
Role Ambiguity	X				X
Role Stress	X				X
Conflict Intensity				X	X

Part I--Tenure

Part I was a demographic data sheet used to obtain general information (16:68). Three questions were structured to obtain measures of tenure, which refers to the length of time (number of months) a program manager was a member of the organization (14:158). This variable is treated as interval level data (10:25).

Part II--Level of Bureaucracy

Part II of the questionnaire was structured around the differences between program and functional organizations as cited by Cleland (Table 2)(4:231). Level of bureaucracy is a set of measurable properties of the organization ranging from a mechanistic to an organistic structure. It is envisioned as a continuum ranging from a functional orientation at one extreme to a program management orientation as the other extreme (17:41).

Nine questions were developed by Lempke and Mann and the responses were solicited on a scale from one to seven. The scores were totaled and averaged to provide an interval measure of the level of bureaucracy of the respondent's tasks (20:51).

Part III--Stress

This section of the questionnaire is from an instrument developed by Rizzo, House and Lirtzman (24) to measure role stress and to determine whether role conflict

and role ambiguity could be clearly identified as intervening variables adding up to role stress (17:41). Miles used this instrument to collect data to evaluate a hypotheses on causal relationships among stress and unfavorable personal results within an organization. Lempke and Mann used the data gathered by this instrument to support the hypothesis that role conflict among managers lessened as tenure in the position increased (17:34-35).

In the Lempke-Mann study, and in the Noyes-Parker effort, role stress was made up of the sum of role conflict and role ambiguity as originally defined by Kahn, Wolfe, Quinn, and Snoek (14:223). The scores of all the questions for each subject were summed and averaged to provide an interval measure of stress.

Part IV--Organizational Climate

For this portion of the questionnaire, Likert's Form S (short form) was used to collect the data. This is a standard instrument for this purpose which is widely reported in the literature. Form S consists of 18 item composites which, when answered, measure individual perceptions of organizational climate (16:29). Litwin and Stringer defined organizational climate as a set of measurable properties of the work environment, perceived directly or indirectly by the workers and assumed to influence their motivation and behavior (18:1).

The values, ranging from zero to forty, were totaled and averaged to provide an interval measure of organizational climate. Use of the interval scale permits the use of most statistical tests, including path analysis, analyses of variance, and Pearson product-moment correlation (16:30).

Part V--Conflict Intensity

Section V of the questionnaire contained only one question, taken from the research efforts of Eschmann and Lee. Eschmann and Lee modified a measuring instrument developed by Thamhain and Wilemon for their study of conflict within the civilian program/project work environment (20:54).

Section V was developed by Noyes and Parker by adapting the question to ask the respondents to rate, on a four-point scale, the amount of conflict intensity they perceived in their organizations in each of seven conflict categories (Table 3). The program phase category information was combined with the corresponding SPO responses to the seven conflict categories, and mean intensity scores for each conflict category in each program phase were computed. The total conflict intensity per phase was then calculated as the mean of means for the seven conflict categories (20:54-55).

Organizational Size

Organizational size, meaning the number of people directly assigned to the program organization on a full-time

basis, was not measured by the questionnaire. However, the size was obtained from the ASD Manning Documents. Size was measured on a ratio scale and is discrete data (20:55).

Interval Scale Data

Sections II, III, IV, and V of the questionnaire gathered data that is interval in nature; that is, a common constant unit of measurement is used that assigns real numbers to objects in an ordered set and uses an arbitrary zero point (20:55-56). Cardinality in scaling was assumed on the basis that equally-appearing intervals are equal (11:70-76).

INSTRUMENT RELIABILITY

"Reliability is an indication of the extent to which a measure contains variable error [13:280]." Variable error is defined as random fluctuations in performance when a person obtains a different score from one testing to the next (13:283). The reliabilities for each section of the overall measuring instrument, used by Noyes and Parker, were tested in previous studies which used the larger instruments from which each section was drawn. Section I of the instrument, the demographic data, is factual material and does not require reliability testing. Section II was developed in the Lempke-Mann thesis, and the test-retest reliability coefficient ($r_{xx}' = .52$) was determined to be

within the boundary values reported by Helmstadter for tests with attitude scales (13:296). The reliability correlation of .52, for the conditions which this section of the questionnaire was constructed and administered, is considered sufficient to lend confidence that much of the variable error in the responses lie external to the questions themselves (17:44-45).

Section III includes the measures of role conflict, role ambiguity and role stress. Reliability was based on the total measure, role stress. It can only be assumed that Rizzo, et al., (24) who developed the instrument on role stress, and Miles (19), who used the instrument extensively, conducted the appropriate reliability tests. At any rate, Lempke and Mann developed a reliability coefficient ($r_{xx}' = .80$) for the scale Role Stress when they investigated the test-retest reliability (20:57). This is deemed to be high within the boundary values established for tests of attitude scales (13:296).

Section IV consists of the Likert Form S questionnaire, which has been used extensively in the area of organizational behavior. Larson and Ruppert performed reliability tests using an analysis of variance process and Spearman-Brown reliability statistic test. Using three categories of data, the reliability coefficients were .72, .95, and .90, indicating high reliability (16:47-49).

Section V is comprised of the Thamhain and Wilemon (26) instrument which has been widely used by them on civilian data to measure conflict intensity. Eschmann and Lee used the instrument on a military population and obtained similar results. However, no specific reliability index has been reported. For the purpose of this study, the assumptions of Noyes and Parker, (that the Thamhain and Wilemon tool is a standard instrument, well accepted in the field, and its reliability is assumed to be high) will be maintained (20:58).

INSTRUMENT VALIDITY

Part I measured demographic data. It is assumed that the respondents answered all the questions truthfully (20:58).

The validity of Part II was established by Lempke and Mann through a series of tests. Since the questions were developed around the concepts expounded by Cleland and others, a certain amount of face validity can be attributed to the questions. Logical validity was demonstrated by subjective evaluation of experts in the field. Face validity was improved by the use of a pilot study with ten individuals experienced as program managers. Finally, an intercorrelation analysis on the questions were performed, yielding high correlation values among the questions as well as between these questions and an independent check question

that was included in their survey (17:46). The conclusion from the intercorrelation analysis, combined with evidence in support of face and logic validity, lends support for the validity of Part II (17:47).

Parts III, IV and V were all developed from documented and established measuring instruments in the field of attitudinal research. Their validity was accepted within the literature (20:59).

STATISTICAL INTRODUCTION

Figure 3 is a diagram depicting the basic pattern of those causal relationships which became the hypothesized model for the Noyes-Parker study. However, their study (using path analysis) did not consider all possible cause and effect relationships among the variables. It is this research study's intent to develop the most mathematically justifiable causal model using independent measurements of each variable obtained from the same measuring instrument at two different points in time. The variables will be analyzed using an approach called "cross-lagged correlational analysis".

Cross-lagged correlational analysis requires the measurement of two variables, X and Y, at two points in time, T_1 and T_2. The question asked of the data is "Does X cause Y, or does Y cause X?" This question can be answered by comparing the correlations between X measured at

T_1 and Y measured at T_2 with the correlation of Y at T_1 and X at T_2. The higher of these cross-correlations is considered to denote the direction of causality (6:663). Or to explain it in more statistical terms; the two variables (X, Y) when they are measured at two different points in time generate four variables (X_1, X_2, Y_1, Y_2) where X and Y denote the variables and the subscripts 1, 2, denote the time period (Figure 4). The cross-lagged correlations can be expressed as a cross-lagged differential:

$$rX_1Y_2 - rX_2Y_1$$

If X causes Y, then the cross-lagged differential would be positive, and if Y causes X, the differential would be negative. If there is no cross-lagged correlation then $rX_1Y_2 - rX_2Y_1$ would equal zero and no causal relationship would exist (15:887).

STATISTICAL PROCEDURE: CROSS-LAGGED PANEL CORRELATION

The cross-lagged panel correlation model, as formalized by Kenny (15), is designed to make inferences about causation possible by (1) determining time precedence between variables, and (2) by eliminating spuriousness as an explanation for the association between two variables, i.e., eliminating a common third variable (Z) as a cause of this correlation between variables (Figure 5) (15:887-890). This

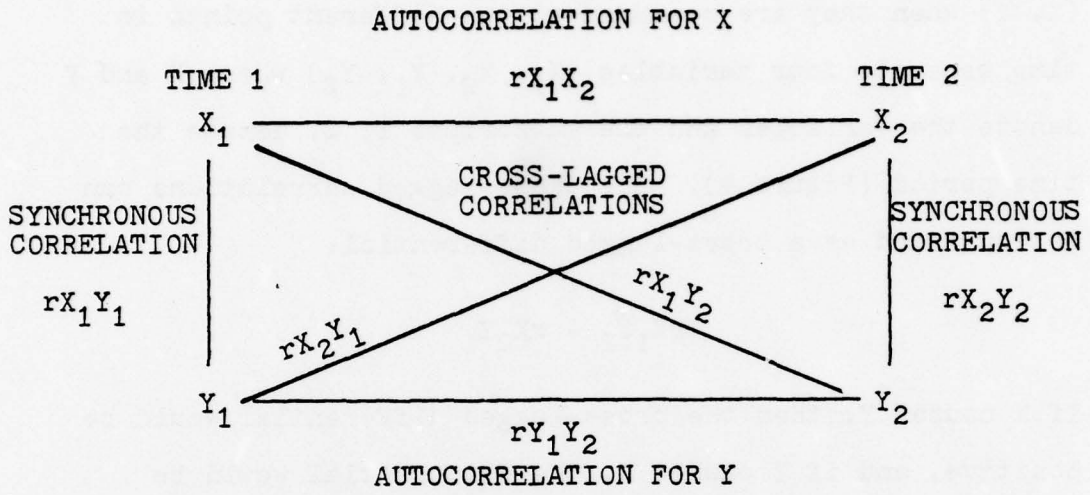


Figure 4. Cross-lagged Panel Correlation Diagram. (X and Y are variables and 1 and 2 are Times) (15:288)

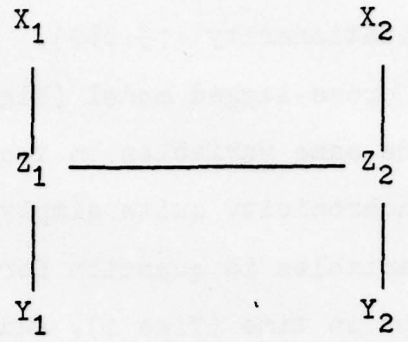


Figure 5. Cross-lagged Panel Correlation Null Hypothesis. (X,Y, and Z are variables and 1 and 2 are Times) (15:889)

model is based on assumptions that must be made for the inference to be valid. Kenny has labeled the two primary assumptions for cross-lagged panel correlation (1) synchronicity, and (2) stationarity (15:889).

The two-wave cross-lagged model (Figure 4) requires the measurement of the same variables on two occasions, and the assumption of synchronicity quite simply states that measurement of the variables in question for the first wave reflect the same point in time (Time 1), and all variables measured for the second wave reflect the same second time period (Time 2). This is usually accomplished by the wording of survey items and by taking two surveys at two distinct points in time (15:289-290). This study does involve analyzing data obtained by measuring survey variables at two distinct points in time using the same survey items. The surveys were held at least one year apart, so the assumption of synchronicity is valid in this situation.

The assumption of stationarity states that the causal coefficients of the variables involved remain stable and don't change over time. The cross-lagged correlation model examines causal relations that occur gradually at an even rate rather than instantaneously over time, and ones that are in stable operation at the times the measurements are taken rather than causal effects that start or change after the initial measurement has been taken. Evidence consistent with the stationarity assumption is equality or near

equality in the size of the two synchronous correlations (rX_1Y_1 and rX_2Y_2). It is also important that the reliability with which a given variable is measured remains constant from Time 1 to Time 2, for each variable in the analysis, since changes in the reliability with which a variable is measured can affect the size of correlation coefficients and consequent interpretation of cross-lagged results (15: 288-293). In summary, near equality of synchronous correlations, and nearly constant reliabilities for each variable at Times 1 and 2, are needed in order to interpret, unambiguously, the results of the cross-lagged correlation model. For this study, the above has been accomplished by using the same measuring instrument, with its reliability values, at two distinct periods of time.

Another issue relative to the interpretation of cross-lagged correlational results is plausible rival hypotheses found in cross-lagged analysis. For example, Rozelle and Campbell (25) showed that a significant difference between cross-lagged correlations that is consistent with the interpretation that variable X causes an increase in variable Y is also consistent with a plausible rival hypothesis that variable Y causes a decrease in variable X, unless a no-cause baseline can be established as a basis to distinguish between these rival hypotheses. Rozelle and Campbell suggest that an average synchronous correlation, corrected for attenuation, could serve to estimate a

no-cause baseline, one that has been corrected for correlated errors that tend to produce a higher correlation between variables measured at the same time than at different times (25:76-79). The synchronous correlations without correction for attenuation probably provide an adequate basis for estimating a no-cause base in the study since many of the correlated errors that tend to inflate synchronous correlations, compared to cross-lagged correlations, are not present when an organization (SPO) rather than an individual is used as the unit of analysis, (1) survey data is averaged across respondents eliminating response sets that may be somewhat random and (2) correlations are made between variables measured from different organizations (samples). These factors may tend to reduce correlated errors that can produce inflated synchronous correlations. In any case, even without an unbiased no-cause baseline, it is possible to distinguish between the two plausible alternative hypotheses where the cross-lagged correlations are significantly larger than synchronous correlations, given the additional assumption that Kenny calls homogenous stability. This assumption states that all errorless causes of the two variables change at the same rate over time (15:893). In summary, given this additional assumption, evidence for distinguishing between the two rival alternative hypotheses identified by Rozelle and Campbell (25) can be obtained by comparing the cross-lagged correlations to the synchronous

correlations (Table 5). If the cross-lagged correlation between variables X_1 and Y_2 is significantly greater than the synchronous correlations, this evidence is consistent with the proposition that X caused an increase in Y. If the cross-lagged correlation between Y_1 and X_2 is also significantly greater than the synchronous correlations, this evidence is consistent with the proposition that Y also caused an increase in X. If the cross-lagged correlation between variables X_1 and Y_2 is significantly less than the synchronous correlations, and negative while the synchronous correlations are positive, this evidence is consistent with the proposition that X caused a decrease in Y, as long as the synchronous correlations can be considered an unbiased estimate of the no-cause baseline. If the synchronous correlations are inflated with correlated errors, these errors will inflate the difference between the synchronous correlations and the cross-lagged correlations, leading to the inference that there is a significant result when there is none (25:76-79).

Interpreting cross-lagged results, then, first involves examining the difference between synchronous correlations, to make sure that this difference is not statistically significant. This is necessary to be consistent with the stationarity assumptions. The reliabilities for each variable, at Times 1 and 2, should be examined next to be sure there is not an appreciable change in the reliability with

Table 5

CROSS-LAGGED INFERENCES (25:74)

SYNCHRONOUS CORRELATIONS	CROSS-LAGGED CORRELATIONS	INFERENCE
LESS THAN	X_1Y_2	X INCREASES Y
LESS THAN	X_2Y_1	Y INCREASES X
GREATER THAN	$-X_1Y_2$	X DECREASES Y
GREATER THAN	$-X_2Y_1$	Y DECREASES X

which a variable is measured from Time 1 to Time 2. Such a change could influence the size of cross-lagged correlations and provide a rival explanation to a causal interpretation of the data. Next the cross-lagged difference (rX_1Y_2 - rX_2Y_1) is examined to see whether it is significant. Then the cross-lagged correlations are compared to the synchronous correlations to distinguish between rival hypotheses, (i.e., X increasing Y, or Y decreasing X). It is of course possible for both causal relations to be operating and for the data to support both hypotheses in one analyses. In some analyses both the cross-lagged correlations could be significantly larger than the synchronous correlations, and the cross-lagged correlations might not be significantly different from each other. A result of this nature is consistent with the interpretation that X increased Y, and also that Y increased X (25:74-79).

A statistic that is an additional aid in interpreting the results of cross-lagged panel analyses is the estimate of the "synchronous common factor" autocorrelation. As may be recalled, one purpose of cross-lagged correlation is to infer causation by ruling out the possibility that the relationship between X and Y is due to an unmeasured third variable (Z). In essence this is the null hypothesis in cross-lagged analyses, that the relationship between two variables could plausibly be due to one common factor (Z) that simultaneously affects variable X and variable Y from Time 1 to Time 2 (Figure 5). In Kenny's (15) terminology this factor has been called a synchronous common factor (Z). It is possible to estimate the size of the autocorrelation (rZ_1Z_2) for this synchronous common factor--which happens to equal the product of the cross-lagged correlations divided by the product of the synchronous correlations.

$$\left[\frac{(rX_1Y_2)(rX_2Y_1)}{(rX_1Y_1)(rX_2Y_2)} \right]$$

If this autocorrelation is greater than 1.0 or less than -1.0, (the range for a correlation coefficient), then a synchronous common factor that simultaneously affects both variables X and Y can be ruled out as a plausible explanation for the relationship between variable X and Y. The autocorrelation for Z is of course an estimate which is influenced by sampling error. No statistical test is available

to measure the certainty with which this autocorrelation can be said to diverge from +1.0 or -1.0. However, the actual difference between the estimated autocorrelation and ±1.0 can be one guide. This measure is, however, sensitive to small changes in nonsignificant correlation coefficients. It makes no sense to examine this autocorrelation if none of the synchronous and cross-lagged correlations are significantly different from zero and a significant cross-lagged difference is absent, since this result indicates an inability to detect a reliable relationship between X and Y. It makes no sense to try to infer causation when a reliable relationship cannot even be detected (15:887-901).

The autocorrelation for the synchronous common factor (Z) has a disadvantage in that a statistical test for this correlation is not currently available. Aside from this, the autocorrelation has an advantage in that it does not require one to make the assumption of stationarity in order to rule out a synchronous common factor as a plausible explanation. However, even if a synchronous common factor can be ruled out, stationarity must be assumed to accept a model that includes a synchronous and cross-lagged common factor (15:290-299).

APPLICATION TO THIS THESIS EFFORT

This research effort attempts to rule out a synchronous common factor as an explanation for the relationship

between two variables, and support a model which is consistent with a synchronous common factor plus a cross-lagged common factor. The previous suggestions are a guide for inferring causation in accordance with a model that assumes stationarity and synchronicity, and infers causation by (1) ruling out a synchronous common factor as an adequate explanation, and (2) replacing it with a model which includes a synchronous common factor plus a common cross-lagged factor. This cross-lagged factor includes time precedence as an aid for inferring causation.

Since the universe, population of interest, and data collection instrument were the same for the previous five research efforts, the data results are deemed compatible to allow for integration (Research Question 1a). The data is arranged in matrix form through use of the Pearson product-moment correlation technique. Cross-lagged correlational analysis is the tool that allows for the integration to be accomplished (Research Question 1b). The variables are considered, two at a time, in all possible combinations. The two variables indicating the highest causal correlations are selected as the building blocks for the causal model. The process is then repeated using a building block variable with the remaining variables until all causal relationships are established. The resulting causal model will be compared with the results obtained by Noyes and Parker when they tested their hypothesized model (Figure 3) using path

analysis. The result will provide the causal model optimized for explaining the relationship, contained in the data collected over a number of years from Air Force Systems Program Offices (Research Question 1c).

ASSUMPTIONS

By necessity, this research was conducted under the assumptions similar to those of the Lempke-Mann (17:55), Larson-Ruppert (16:42), Haddox-Long (10:25-26), Eschmann-Lee (5:56-57) and Noyes-Parker (20:70-71) studies:

1. The data to be collected are based on perceptions. It is assumed that the data that was gathered and the information obtained from it is representative of the true relationships that exist. This assumption is based on the analyses conducted in the various prior theses efforts.

2. The sample of SPO managers is representative of the population of SPO managers assigned to system program offices within the Aeronautical Systems Division.

3. Each respondent answered each question independently, and the responses are reflective of the individual's true feelings.

4. Definitions and assumptions from supportive research studies are valid and reasonable. For example, stratified categories within the weapon system acquisition process are logically and sufficiently defined to allow further research.

5. Uncontrolled variables that exist in SPOs at different categories of the weapon system acquisition process remain distinctive to those categories.

6. The full cooperation of the randomly selected program managers within ASD was obtained and resulted in the collection of unbiased data.

LIMITATIONS

1. The study is limited to the various program offices at ASD at Wright-Patterson Air Force Base, Ohio.

2. The results of this study may be formally generalized only to system program offices within the Aeronautical Systems Division, AFSC.

3. Validity of the results comparing the data collected in this study to that collected by the five previous studies (5; 10; 16; 17; 20) is limited by the validity of results reported by those previous studies.

Chapter 4

DATA ANALYSIS AND INTERPRETATION

A detailed analysis of the data was performed to determine if they were amenable to the cross-lagged analysis technique. The data did not strictly conform to what is normally required for cross-lagged analysis, and thus required the researchers to attempt to adapt the methodology without seriously violating the necessary assumptions. This involved making additional assumptions concerning individual versus organizational responses. Because of the nature of the data and the additional assumptions made, the thrust of this research had to be revised to demonstrate (1) adapting individual responses to organizational responses and viewing the resultant data via cross-lagged analysis, (2) using a portion of the data which was amenable to cross-lagged analysis to demonstrate the technique itself, and (3) discussing what events must occur in order to use this technique in a valid effort to analyze the relationships among all the organizational variables in question for causality.

EXAMINATION OF COLLECTED DATA

The raw data used in this report was collected by four different research teams. A discussion of how it was

collected appeared in an earlier chapter (pages 32-38). The research team agrees that valid, reliable instruments were used and that the data in and of itself is definitely reliable. The only question that must be answered then, is whether or not the data is of a form that can be used in the cross-lagged analysis technique. The first doubt was generated by reviewing the times at which the data was collected. One of the assumptions in cross-lagged analysis is that of synchronicity; the two constructs (variables) being considered must be measured simultaneously and on two different occasions (Figure 4). For all the data collected at Time 2 (Noyes and Parker study) this assumption is met. But for some of the data collected at Time 1 this assumption may be irrevocably violated. Although the data on the organizational variables role conflict, role ambiguity, and role stress were collected by Lempke and Mann while the data on conflict intensity were collected by Eschmann and Lee, both teams gathered their data in relatively the same time period. However, the data on the remaining variables organization size, tenure, and organizational climate were collected six to nine months earlier by Larson and Ruppert. Instead of the cross-lagged diagram appearing as in Figure 4, for at least some of the variables it will look like Figure 6. What effects this will have on the analysis is very difficult if not impossible to tell (see the note on Figure 6). Kenny has stated that it is common to find variables

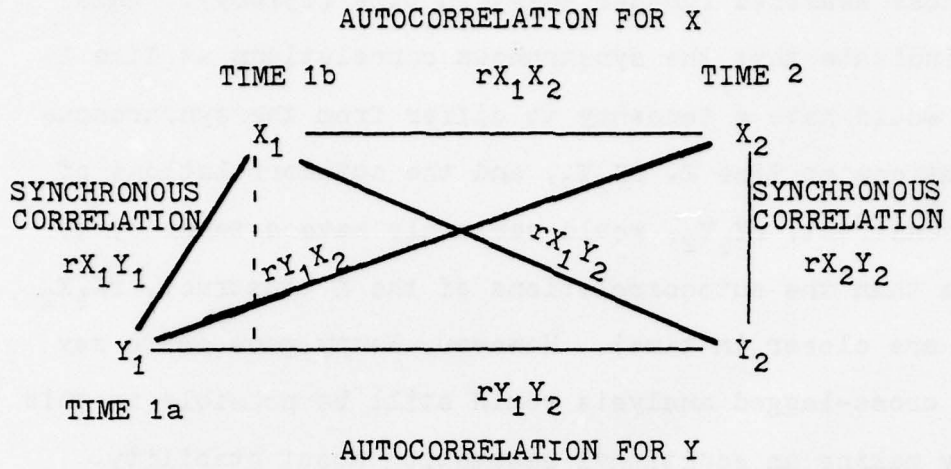


Figure 6. Cross-lagged Panel Correlation Diagram without Strict Synchronicity. (X and Y are variables and 1 and 2 are Times)

NOTE: The difference (Time 1b-Time 1a) is much smaller than the difference (Time 2-Time 1b). Nevertheless, Time 1a $\neq$ Time 1b, and the effect of this violation of the assumptions necessary for cross-lagged analysis cannot be determined.

measured closer together in time more highly correlated than those measured further apart in time (15:889). This would indicate that the synchronous correlations at Time 1, rX_1Y_1, would have a tendency to differ from the synchronous correlations at Time 2, rX_2Y_2, and the autocorrelations of the Y construct, rY_1Y_2, would certainly have a tendency to be less than the autocorrelations of the X construct, rX_1X_2 (which are closer in time). However, Kenny goes on to say that a cross-lagged analysis would still be possible in this case by making an additional assumption about stability. Stability, which is measured by the autocorrelations, indicates a lack of change over time of the empirical values of a variable (15:889 note 3, 890). This simply means that this data may still be useable depending on the information that can be derived from the shell of the cross-lagged panel, i.e., differences in the autocorrelations and the synchronous correlations. The shell of the cross-lagged panel is comprised of the autocorrelations and synchronous correlations which surround the cross-lagged correlations and is depicted as in Figure 7.

Another indication that complications would arise in the cross-lagged analysis was developed when viewing <u>who</u> the data were collected from. The cross-lagged technique was developed for, and in fact most of its reported uses have been on, matched individual responses. That is, an individual is measured on certain variables at one point

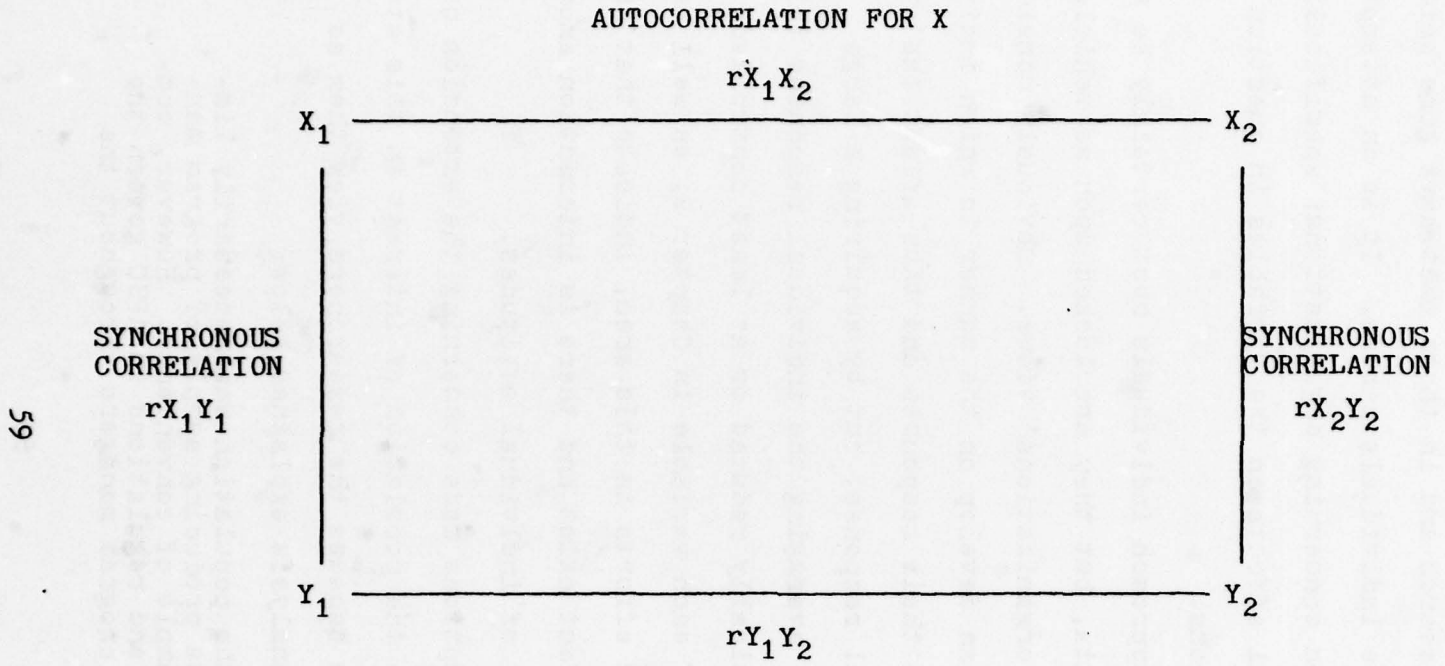


Figure 7. Cross-lagged Shell

in time, and that same individual is measured on the same variables by the same instrument at a different point in time. In this research and in those that have gone before, the aim is not the individuals per se. It is an attempt to derive information concerning organizations; specifically, to identify causal effects on the variables in question across organizations.

In this approach individuals must certainly be used to provide the data, but they are looked upon as vehicles which impart the organizations' views. Obviously considerable discussion can develop on the manner in which individuals sway or bias their responses and thus affect the overall organizational response, but by acquiring a large enough sample and averaging the individual responses this bias can be drastically reduced or at least controlled. The discussion of each variable in Chapter 2, as well as the previous research efforts in this area, indicate that these variables do in fact exist and there is interaction among them irrespective of individual attitudes.

The assumptions made concerning the extension of research results to the population of interest in this study are repeated here because the researchers view them as critical to the analysis explained below:

> Because the population was necessarily limited, the data producing sample of program managers is a sample of convenience. However, common policies and regulations in AFSC govern the selection of program managers throughout the

> command. Additionally, the military members of the population share a variety of common experiences, including professional education, military training, and a multitude of military socializing influences. The results of this study may be applied to the broader population [17:37].

Key words in this assumption are common policies and regulations, common professional education, common military training, and common socializing influences. The cumulative result of all this commonalty is its effect on the individual responses. The responses by individuals with similar backgrounds and training, experiencing the same pressures, and operating under the same policies can be expected to be similar. It is this reasoning that led the researchers to combine the data defined as Time 1 to form one organizational response, recognizing that it was gathered by three different teams. The difficulty was in matching the responses across collecting teams. In light of the previous discussion, it was felt that individuals with the same length of time in a SPO (even though it was not the same SPO) would respond in a like manner. Therefore, the data of Lempke and Mann on role conflict, role ambiguity, role stress, and level of bureaucracy was combined with the Larson and Ruppert data of organization size, tenure, and organizational climate by matching the tenure of respondents. The data collected by Eschmann and Lee on conflict intensity was also handled in this manner, but few matches existed for data fields indicating the same or similar tenure.

Because of this small number of match-ups, there is little hope for any meaningful results for the variable conflict intensity.

At this stage the data in both Time 1 and Time 2 is arranged as if a single individual had responded to each variable, though not the same individual at Time 1 as at Time 2. Time 1 data are matched by tenure and Time 2 data are the actual responses of one individual on all the variables in question. However one further problem remains. Prior discussion of pure cross-lagged analysis pointed out that the same individual must respond in Time 1 as in Time 2. Because of the promise of confidentiality that each research team gave to its research subjects, neither individual respondents nor organizations could be unambiguously matched across time. In an effort to overcome this problem, the researchers assumed that organizational responses would be most similar from organizations of the same size. Analyses by Adams and Barndt supported this assumption (1). Therefore, the data were lined up pairwise by organization size, i.e., the responses of an organization of 15 people in Time 1 was lined up with the responses of an organization with approximately 15 people in Time 2. During the alignment of Time 1 and Time 2 data it was discovered that no realistic match of organizations could be made with the data available in Phase II, Full Scale Engineering and Development. Consequently, the analysis was limited to data from

Phase 1, Conceptual, and Phase III, Production and Development. Thus the data is now grouped by (1) phase (excluding Phase II), (2) tenure, and (3) size. An obvious extension at this point would be to eliminate phase as a variable and combine all data for a larger sample size. This was accomplished and will be discussed later in the study.

Clearly a number of assumptions have been made in this research effort that should not normally be required in cross-lagged analysis. These additional assumptions could invalidate the results, or prevent indications of causal properties which may very well exist within the organizational variables under study from being demonstrated. It was considered necessary and reasonable to make these assumptions in order to demonstrate the technique of cross-lagged correlational analysis on organizational variables. The important point to stress is that because of the necessary additional assumptions, at best this study can provide only indications of support for causal relationships.

A summary of actions taken to adapt the data for use in cross-lagged analysis follows:

1. Match the data collected on role conflict, role ambiguity, role stress, and level of bureaucracy (collected by Lempke and Mann) with organization size, tenure, and organizational climate (collected by Larson and Ruppert) using the variable tenure (which was collected by both teams) as the driving or common variable.

2. Match the data collected on the variable conflict intensity (collected by Eschmann and Lee) with all the other variables again using tenure as the common variable.

3. Match the responses of the respondents in Time 1 with that of the respondents in Time 2 by using the variable organization size as the common variable.

4. Eliminate the data in Phase II because of the inability to realistically match the common variable organization size.

These manipulations may have invalidated the study as a means of drawing inferences about Air Force SPO's, but they did provide a structural data base for use in demonstrating the methodology. This point will be discussed in detail in Chapter 5.

INITIAL ANALYSIS

The compilation of all raw data into appropriate files is presented in Appendix C, while the computer programs used to compute correlation coefficients for all possible pairs of variables are presented in Appendix D. Bear in mind that these correlations are not controlled for the influence of other variables. The matrix of coefficients obtained from the Phase 1 data is presented in Table 6. Throughout the discussion of the cross-lagged analysis as applied to the data in this study, the area of concentration is on those relationships outlined in the model in

Figure 3. At the risk of being redundant, it must be stressed that, because of the uncertainty of the data, indications of causal relationships are all that can be expected.

In viewing Table 6, the small negative and positive coefficients are not significantly different from zero, indicating that no relationship exists between those variables at all. These noncorrelations could be the result of an inordinate amount of measurement error. Another very plausible reason is the manipulation of the Time 1 data that had to be performed. It should be remembered that even though prior research efforts did not establish definitive causal relationships among the universe of organizational variables they all established that relationships did in fact exist among selected variables. This pattern of relationships was used to form the model in Figure 3. Because of this pattern, some of the correlation coefficients were expected to be stronger than those shown in Table 6.

To illustrate the difficulties encountered in this first analysis, an examination of several of the relationships via cross-lagged diagram is warranted. Table 7 contains the correlation coefficients obtained between the variables role conflict, role ambiguity, and role stress. Recall in the literature that, by definition, role stress is the sum of role conflict and role ambiguity. Therefore, strong positive correlations would be expected. However,

Table 6

PHASE I MATRIX OF CORRELATION COEFFICIENTS

VARIABLE	1[b]	2	3	4	5	6	7	8
1. Size (1)[a]	99.0							
2. Tenure (1)	99.0	1.0						
3. Organizational Climate (1)	99.0	-492	1.0					
4. Level of Bureaucracy (1)	99.0	-064	-088	1.0				
5. Role Conflict (1)	99.0	086	-167	075	1.0			
6. Role Ambiguity (1)	99.0	-176	304	386	261	1.0		
7. Role Stress (1)	99.0	273	-104	018	-139	-368	1.0	
8. Conflict Intensity (1)	99.0	-084	-385	-067	-108	-706	-039	1.0

VARIABLE	1[b]	2	3	4	5	6	7	8
9. Size (2)	99.0	-273	109	-196	-200	-151	177	-117
10. Tenure (2)	99.0	371	-284	033	-150	-302	280	297
11. Organizational Climate (2)	99.0	-385	536	-173	-238	177	005	-184
12. Level of Bureaucracy (2)	99.0	-294	237	-043	042	-178	114	259
13. Role Conflict (2)	99.0	260	-031	-287	-351	-260	154	-077
14. Role Ambiguity (2)	99.0	183	-327	200	-013	-102	-447	353
15. Role Stress (2)	99.0	056	-376	-173	449	-125	-175	266
16. Conflict Intensity (2)	99.0	380	-485	-112	-179	-284	-052	333

VARIABLE	9	10	11	12	13	14	15	16
9. Size (2)	1.0							
10. Tenure (2)	-051	1.0						
11. Organizational Climate (2)	179	140	1.0					
12. Level of Bureaucracy (2)	-108	323	284	1.0				
13. Role Conflict (2)	-245	008	-056	-091	1.0			
14. Role Ambiguity (2)	-237	163	-190	115	014	1.0		
15. Role Stress (2)	-083	315	-052	368	-184	476	1.0	
16. Conflict Intensity (2)	-073	-022	-297	-129	-075	491	319	1.0

NOTE: Decimal points for all correlations less than 1.0 have been omitted.

a The number in parenthesis refers to the Time the variable was measured.

b A value of 99.0 is printed if a coefficient cannot be computed.

in viewing Table 7 the strong negative coefficients indicate exactly the opposite. Figure 8 contains the cross-lagged diagram of role conflict and role stress. An examination of the shell is the first step in the analysis. As stated before, the autocorrelations are an indication of stability. In this case even though the autocorrelations are negative, they are sufficiently strong enough to assume reasonable stability. The synchronous correlations (values) are also negative, but are nearly equal. This indicates the assumption of stationarity (the strength and direction of the causes of a variable have not changed over time) has not been violated. At this point the cross-lagged correlations can be examined. Here a significant difference in the correlations is apparent. This strong difference is very much in favor of role conflict causing role stress, a finding which supports the previous research. Notice also that the cross-lagged correlation between role stress and role conflict is greater than the synchronous correlations. This is an indication that while role conflict is the predominate causal variable there is a feedback loop in effect wherein role stress increases or reinforces role conflict.

Another illustration of the relationships among these variables is presented in Figure 9, the cross-lagged diagram for role ambiguity and role stress. Here difficulty is encountered when analyzing the relationships among the variables. While the autocorrelations appear reasonable

Table 7

CORRELATION OF ROLE CONFLICT, ROLE AMBIGUITY, AND ROLE STRESS

VARIABLE	1	2	3	4	5	6
1. Role Conflict (1)[a]	1.0					
2. Role Ambiguity (1)	261	1.0				
3. Role Stress (1)	-139	-368	1.0			
4. Role Conflict (2)	-351	-260	154	1.0		
5. Role Ambiguity (2)	-031	-102	-447	014	1.0	
6. Role Stress (2)	449	-125	-175	-184	476	1.0

NOTE: Decimal points for all correlations less than 1.0 have been omitted.

a The number in parenthesis refers to the Time the variable was measured

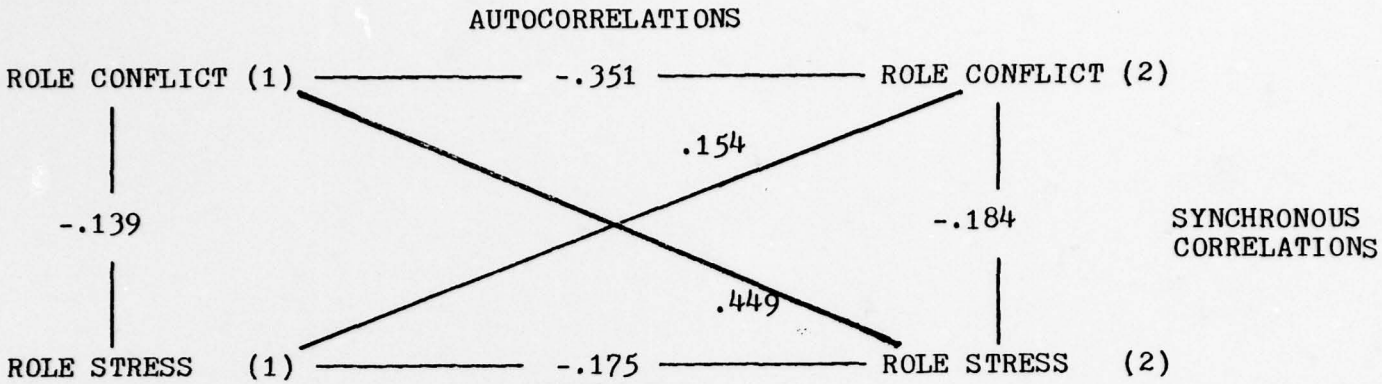


Figure 8. Cross-lagged Diagram for Role Conflict and Role Stress

Phase I

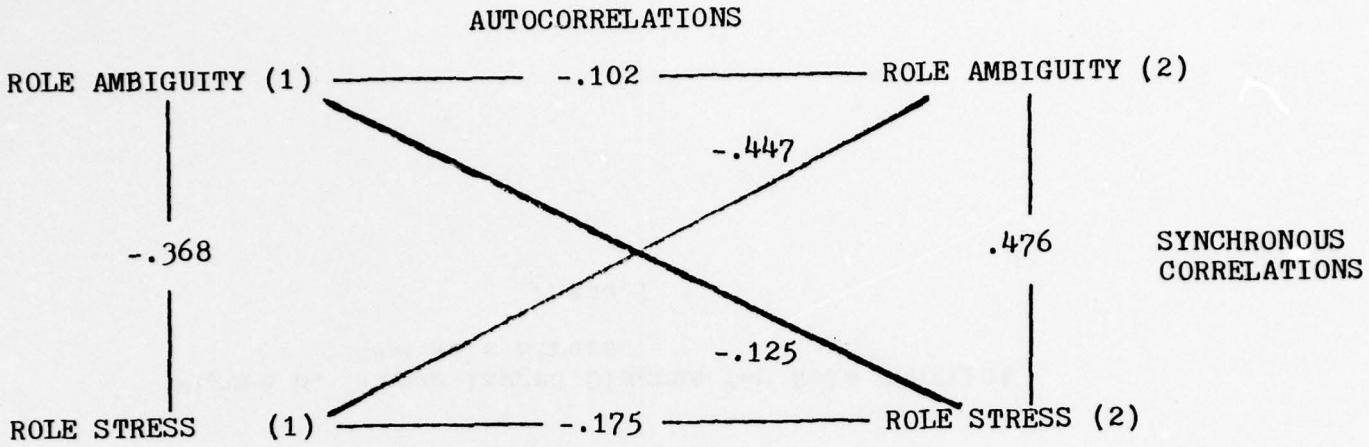


Figure 9. Cross-lagged Diagram for Role Ambiguity and Role Stress

Phase I

(indicating stability) there is a considerable difference in the synchronous correlations (-.368 in Time 1 and +.476 in Time 2).

This difference could be the result of a change in the structural relationship of the variables over time (something else in the organization caused the relationship between the variables to change over time) or a change in the reliability of the measurements at different times. If in fact, the difference is due to measurement error the correlations could be corrected for attenuation and the cross-lagged correlations then examined for causal properties. But if the structural relationship among the variables was altered, this technique would be of no benefit. There is no way to tell, in this study, which of the two possibilities may have affected the results.

Another of the relationships that might be examined is that of tenure and organizational climate. In the Noyes and Parker model (20) an inverse relationship was exhibited between these variables. The more tenure a program manager had, the more functionally oriented he became and the more the organizational climate deteriorated. The cross-lagged diagram for these variables is presented in Figure 10. This diagram illustrates several interesting points. First, the autocorrelations are very reasonable and consistent with the literature, thereby indicating stability between both measurements. The synchronous correlations are negative in

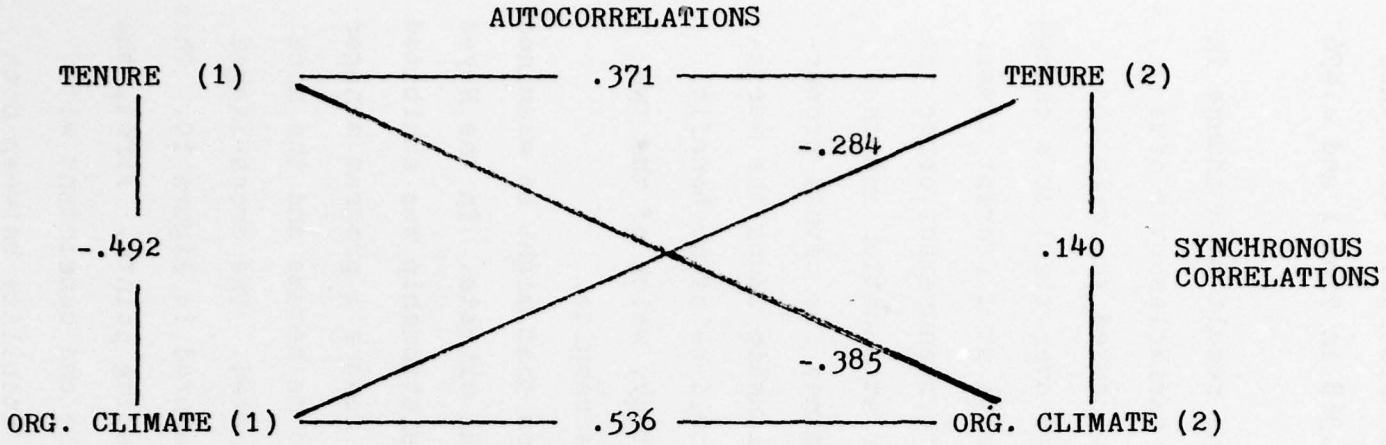


Figure 10. Cross-lagged Diagram for Tenure and Organizational Climate

Phase I

Time 1 (indicating the expected inverse relationship) but cannot be considered different from zero in Time 2, a situation which inturn indicates no or almost no relationship between the variables. The difference between these synchronous correlations might be the result of a change in the reliability of measurement at Time 2. If so, this could be corrected. Assuming the correction could be made, examination of the cross-lagged correlation coefficients reveals support for the Noyes and Parker hypothesized relationship between tenure and organizational climate (as the tenure of a program manager increases the perceived organizational climate decreases) (15:152).

The Noyes and Parker model also indicated an inverse relationship between organizational climate and both role ambiguity and role conflict (15:149, 153). The cross-lagged diagrams for these variables are presented in Figures 11 and 12. Examining the shell in both diagrams reveals many violations of the assumptions, preventing conclusions from being drawn in support or rejection of the Noyes and Parker model.

The matrix of coefficients for the Phase III data is presented in Table 8. Again a large number of noncorrelations (small positive or negative coefficients not significantly different than 0) is obvious. Since the technique has been explained and demonstrated at some length, the cross-lagged diagrams will be shown and only significant

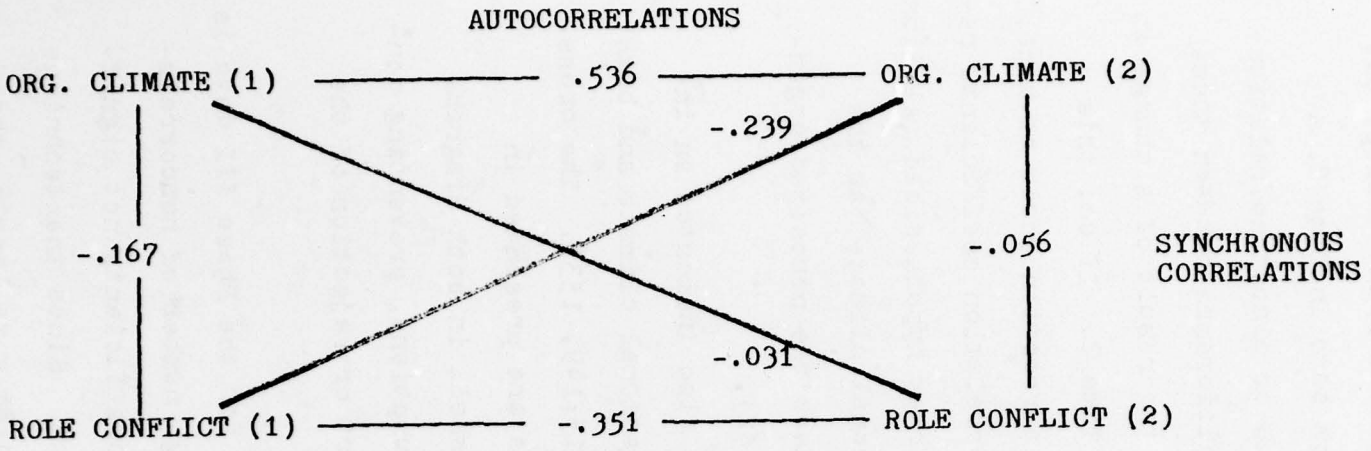


Figure 11. Cross-lagged Diagram for Organizational Climate and Role Conflict

Phase I

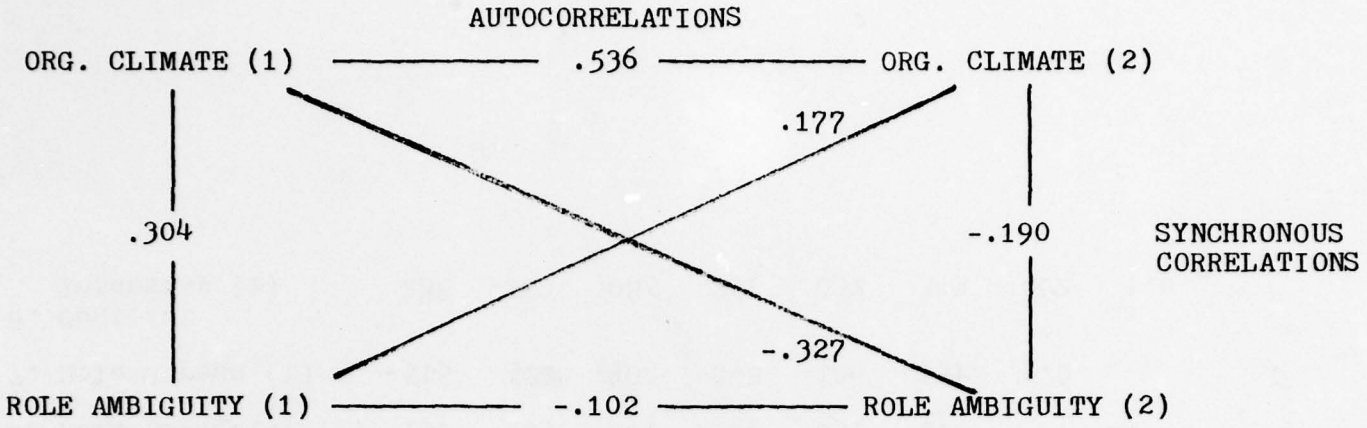


Figure 12. Cross-lagged Diagram for Organizational Climate and Role Ambiguity

Phase I

Table 8

PHASE III MATRIX OF CORRELATION COEFFICIENTS

VARIABLE	1	2	3	4	5	6	7	8
1. Size (1)	1.0							
2. Tenure (1)	-984	1.0						
3. Organizational Climate (1)	121	-125	1.0					
4. Level of Bureaucracy (1)	237	-128	164	1.0				
5. Role Conflict (1)	079	-121	-086	-010	1.0			
6. Role Ambiguity (1)	130	-183	001	-167	031	1.0		
7. Role Stress (1)	-515	522	-402	048	-106	-151	1.0	
8. Conflict Intensity (1)	288	-269	085	351	037	349	062	1.0

VARIABLE	1	2	3	4	5	6	7	8
9. Size (2)	-236	241	024	-274	176	-325	162	-275
10. Tenure (2)	878	-949	122	-075	184	260	-491	213
11. Organizational Climate (2)	350	-329	246	049	416	092	-219	-202
12. Level of Bureaucracy (2)	430	-367	124	323	057	-167	-467	-195
13. Role Conflict (2)	306	-257	-210	157	-054	-302	-007	114
14. Role Ambiguity (2)	-006	-042	-071	-032	-309	-137	045	-147
15. Role Stress (2)	-007	-080	-288	-395	140	-044	-202	028
16. Conflict Intensity (2)	207	-201	-063	271	216	149	-423	047

VARIABLE	9	10	11	12	13	14	15	16
9. Size (2)	1.0							
10. Tenure (2)	-228	1.0						
11. Organizational Climate (2)	218	266	1.0					
12. Level of Bureaucracy (2)	-045	226	129	1.0				
13. Role Conflict (2)	054	151	-099	-061	1.0			
14. Role Ambiguity (2)	-200	123	-264	065	-254	1.0		
15. Role Stress (2)	053	226	-186	064	023	361	1.0	
16. Conflict Intensity (2)	-270	172	076	293	042	178	291	1.0

NOTE: Decimal points for all correlations less than 1.0 have been omitted.

a The number in parenthesis refers to the Time the variable was measured.

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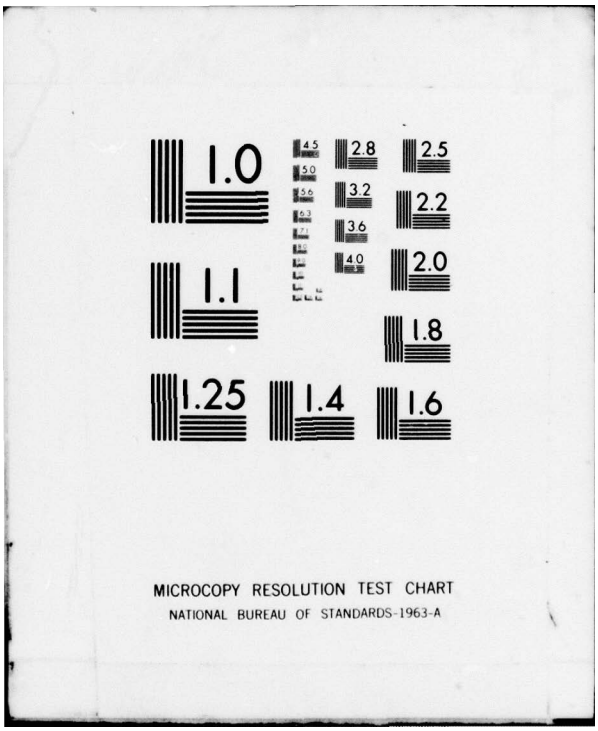
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relationships highlighted. Figures 13 thru 20 depict the cross-lagged diagrams of the variables in Figure 3. As expected, only minor support for the proposed causal relationships is evident.

The cross-lagged correlations in Figure 13 support the Noyes and Parker findings that as organization size increases organizational climate tends to improve (this is contradictory to the findings of Lempke and Mann and Larson and Ruppert). Figure 15 is very inconclusive concerning the variables level of bureaucracy and organizational climate. If there is any evidence in the diagram at all it would be supportive of spuriousness (third variable being the predominant causal variable). Figure 18 shows some support for role conflict being a causal factor of role stress but here again the finding is inconclusive.

Certainly the causal relationships suggested and supported in the previous discussion can be questioned and the researchers accept that fact. The remarks which prefaced the analysis bear repeating. Only <u>indications</u> were sought. Irrefutable evidence of causal relationships was impossible in light of the way the data had to be manipulated to even attempt the analysis. Still, in the opinion of these researchers the indications which were demonstrated in the analysis would be useful, and they warrant further research of this type. The important point here is that the methodology can successfully analyze organizational data of this type.

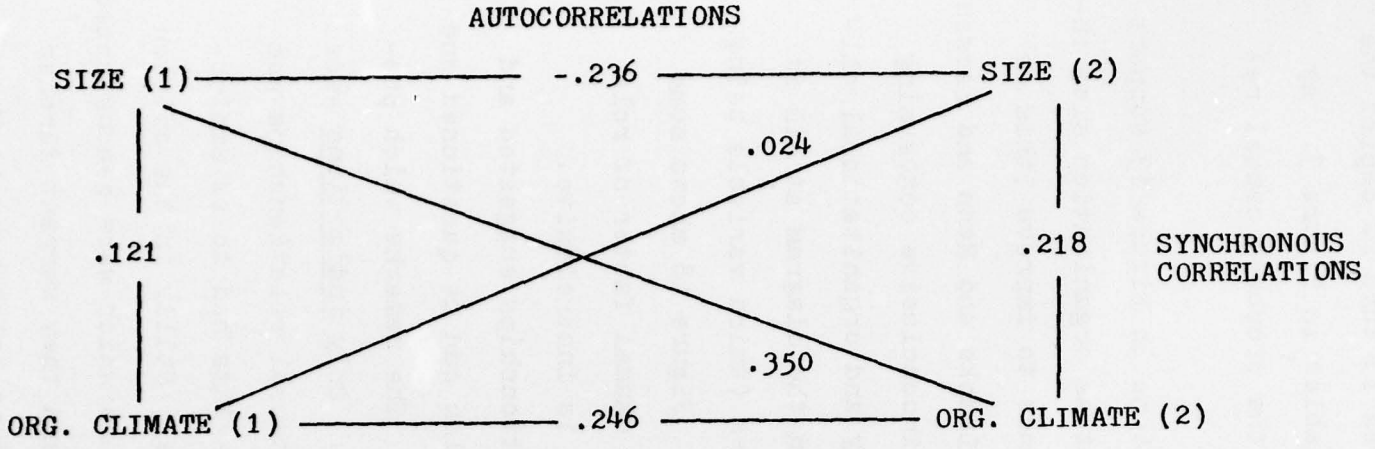


Figure 13. Cross-lagged Diagram for Organization Size and Organizational Climate

Phase III

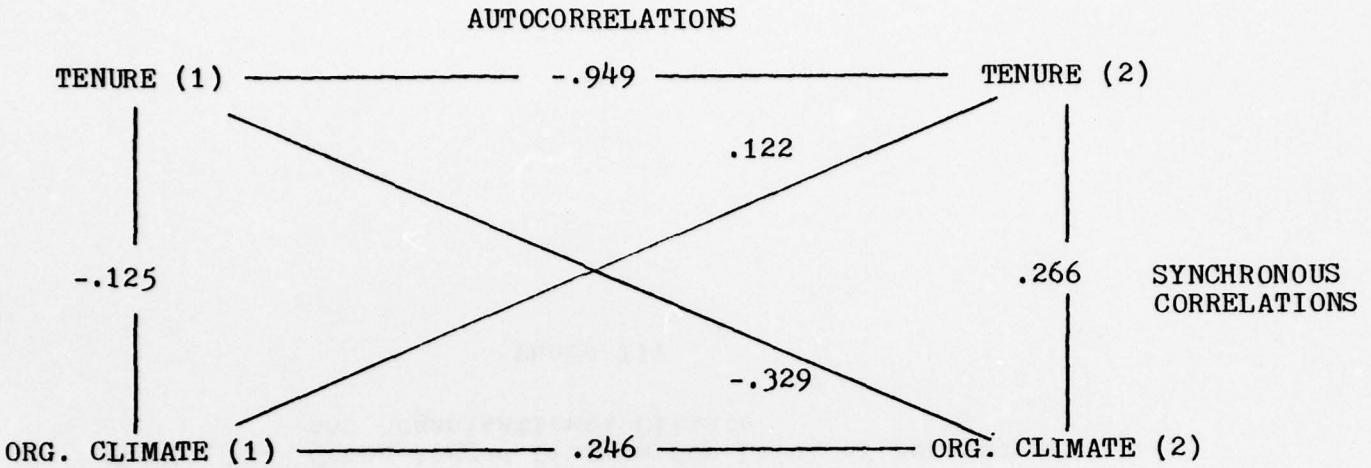


Figure 14. Cross-lagged Diagram for Tenure and Organizational Climate

Phase III

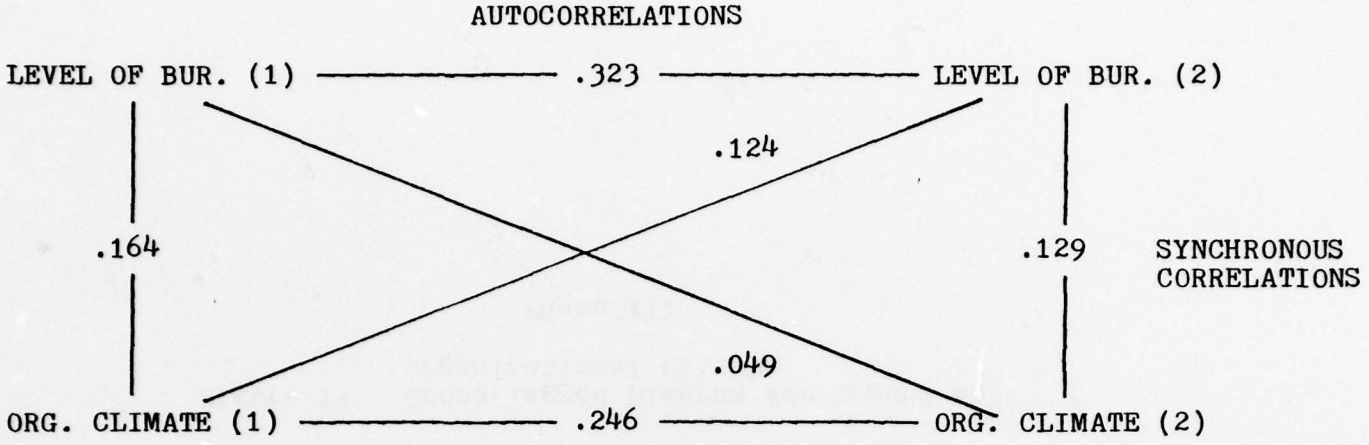


Figure 15. Cross-lagged Diagram for Level of Bureaucracy and Organizational Climate

Phase III

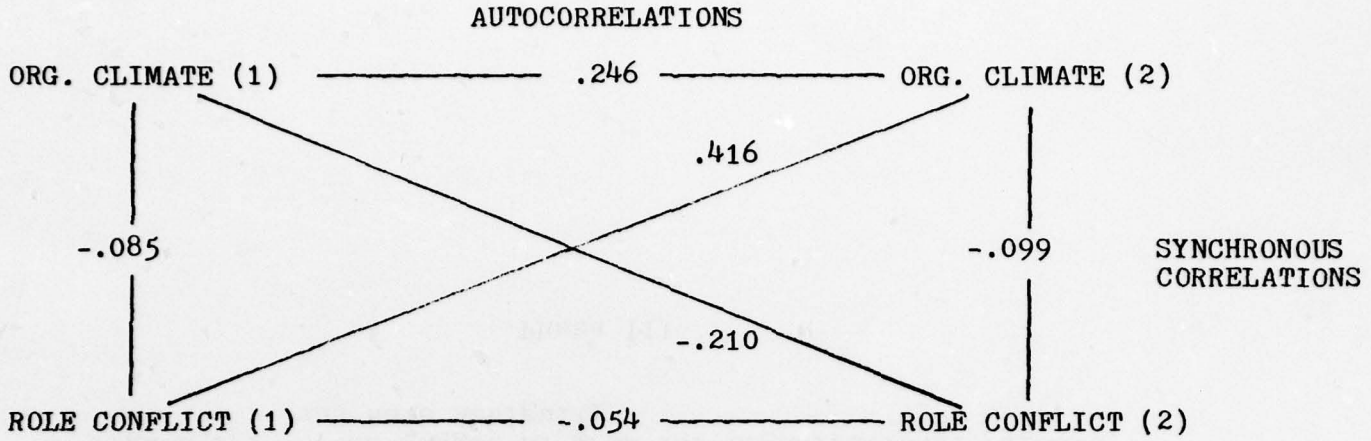


Figure 16. Cross-lagged Diagram for Organizational Climate and Role Conflict

Phase III

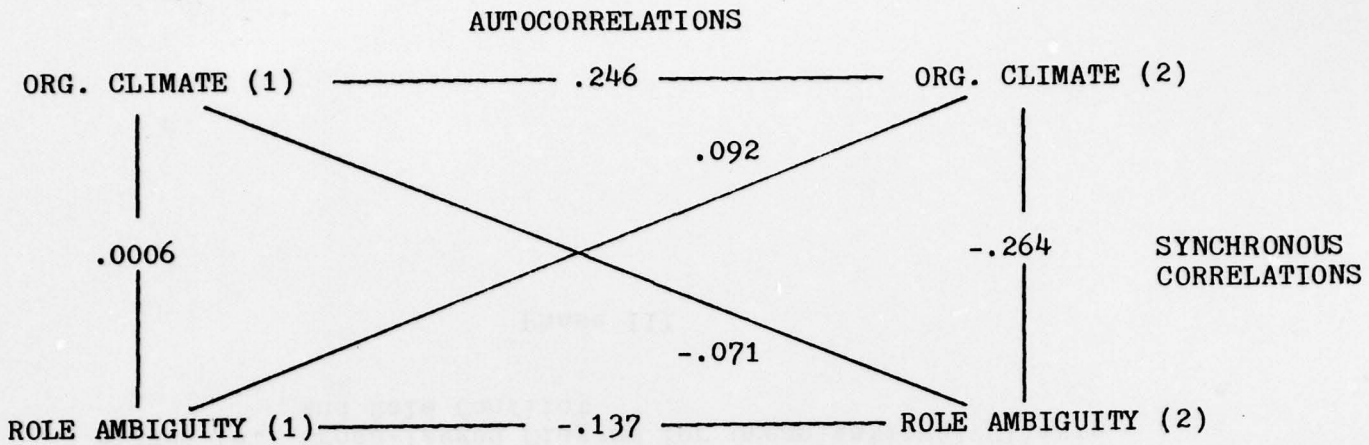


Figure 17. Cross-lagged Diagram for Organizational Climate and Role Ambiguity

Phase III

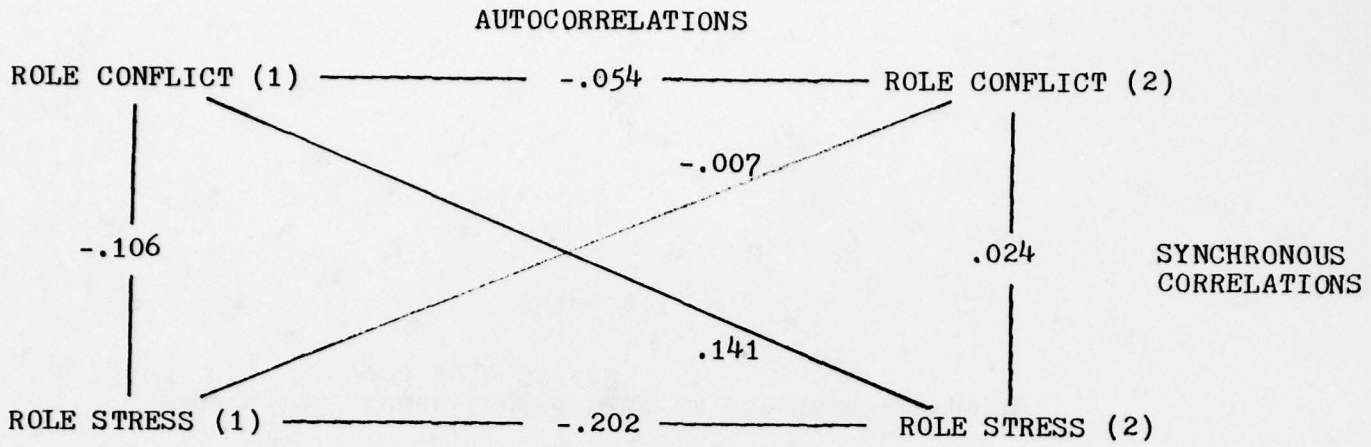


Figure 18. Cross-lagged Diagram for Role Conflict and Role Stress

Phase III

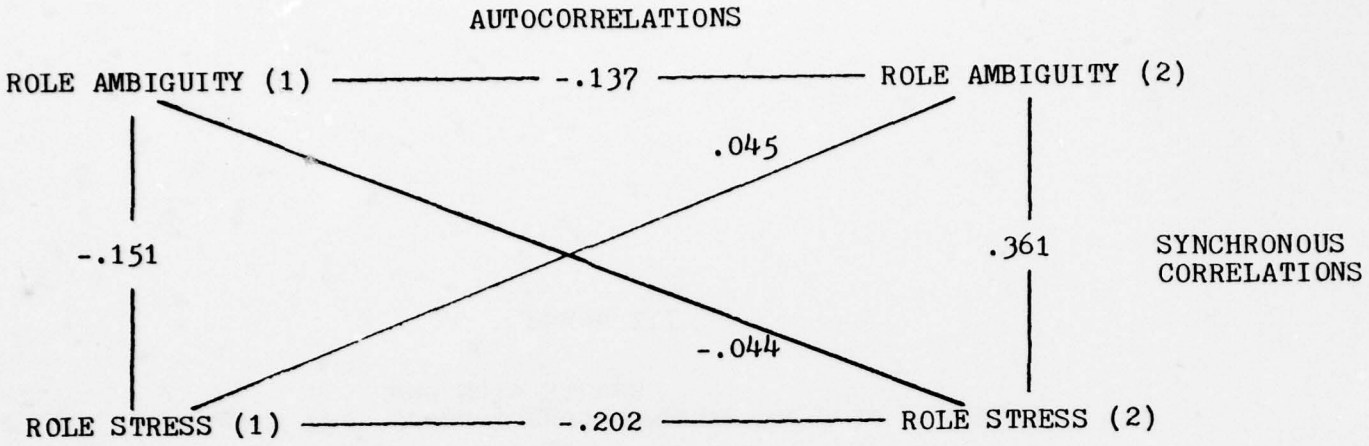


Figure 19. Cross-lagged Diagram for Role Ambiguity and Role Stress

Phase III

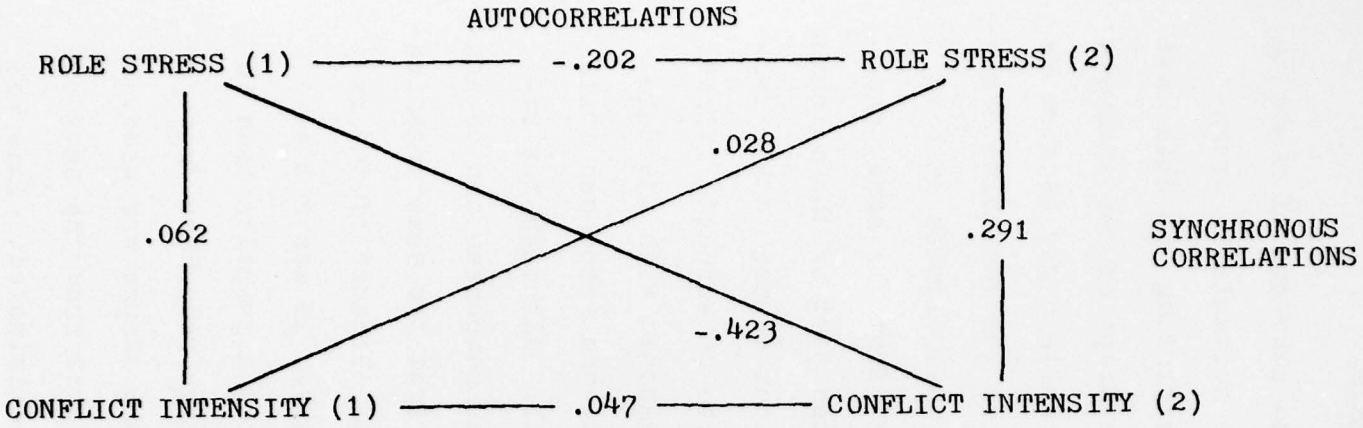


Figure 20. Cross-lagged Diagram for Role Stress and Conflict Intensity.

Phase III

ADDITIONAL ANALYSIS

During the previous analysis, portions of the data from each time frame were found more suitable to cross-lagged analysis than others. By restricting the data used to only those suitable portions, the scope of the analysis is necessarily restricted but the results might be more reliable. Some of the data collected on the variables organization size, tenure, and organizational climate at both points in time were in fact collected from the same organizations. This, of course, eliminates part of the matching accomplished in the prior analysis, but several other factors could still cause the findings to be suspect. First, although the data in Time 1 can be matched with the data from the same organization in Time 2, the responses still did not come from the same individual. Although the researchers believe that organizational responses can be analyzed, averaging over all responses from the same organization should normally be accomplished. Because of the reduction in sample size this would cause, it was not accomplished in this study. Instead the assumption made in the initial analysis concerning similar responses from program managers with equal or near equal tenure was used.

When matching the data collected from the same organizations, the variable phase was eliminated. This was necessitated by the fact that between T_1 and T_2, several of the SPO's had progressed from one phase of the weapon

system acquisition process to another creating a possible second problem dealing with the stationarity assumption. Kenny has stated:

> Stationarity presumes that the causal processes did not change during the interval measured. This argument would not be reasonable if there were evidence that the subjects moved into a different stage over time, because a change in stage implies that the causal determinants, and therefore the causal structure, have changed over time [15:890].

Although the movement of the SPO from one phase to another causes changes in many of the organizational variables, this change in phase is not what Kenny implied when discussing a "change in stage". A change in stage would result when the entire environment was altered, and it is obvious that this does not occur when a SPO moves into another phase. The researchers are of the opinion that this change in phase can be treated as a variable and in fact is by the variable organization size. In reviewing the literature it was found that organizations are small in Phase I, larger in Phase II, and relatively small again in Phase III. The size of the organization changes as the SPO moves through its life cycle and this size, a structural variable, can be altered to bring about desired changes in the behavior variables. The movement into one phase or another by itself will, therefore, not change the structure of the causal relationships.

The matrix of correlation coefficients for the three variables in question is found in Table 9. The individual

Table 9

CORRELATION ACROSS PHASES OF SIZE, TENURE, AND ORGANIZATIONAL CLIMATE

VARIABLE	1	2	3	4	5	6
1. Organization Size (1)[a]	1.0					
2. Tenure (1)	681	1.0				
3. Organizational Climate (1)	-135	-100	1.0			
4. Organization Size (2)	-203	-238	045	1.0		
5. Tenure (2)	537	799	126	-191	1.0	
6. Organizational Climate (2)	130	153	051	-024	207	1.0

NOTE: Decimal points for all correlations less than 1.0 have been omitted.

a The number in parenthesis refers to the Time the variable was measured.

cross-lagged diagrams are presented in Figures 21 thru 23. The correlation of tenure from Time 1 to Time 2 is very high because this variable was used as the matching variable. This fact could also be affecting the other correlations. In analyzing each diagram, it is clear that Figures 21 and 23 cannot provide useful information as the correlations comprising the shell prevent examination of the cross-lagged correlations. However, the autocorrelations and synchronous correlations in Figure 22, organization size and organizational climate, are such that the cross-lagged correlations can be examined. The difference in the cross-lagged correlations supports the Noyes and Parker hypothesis that size has a positive effect on climate. Little else can be drawn from this particular analysis.

As in the initial analysis, the conclusions drawn here resulted from making additional assumptions concerning the data and may be subject to question. However, the support for several of the hypothesized relationships in the Noyes and Parker model and the demonstrated use of the cross-lagged technique for organizational variables are considered both useful and important by the researchers. An obvious extension to this study is the collection of additional data on all the variables for use as Time 2 data, with the Noyes and Parker data then becoming Time 1 information. This could provide two sets of consistent, compatible data which would support an accurate and detailed cross-lagged causal analysis.

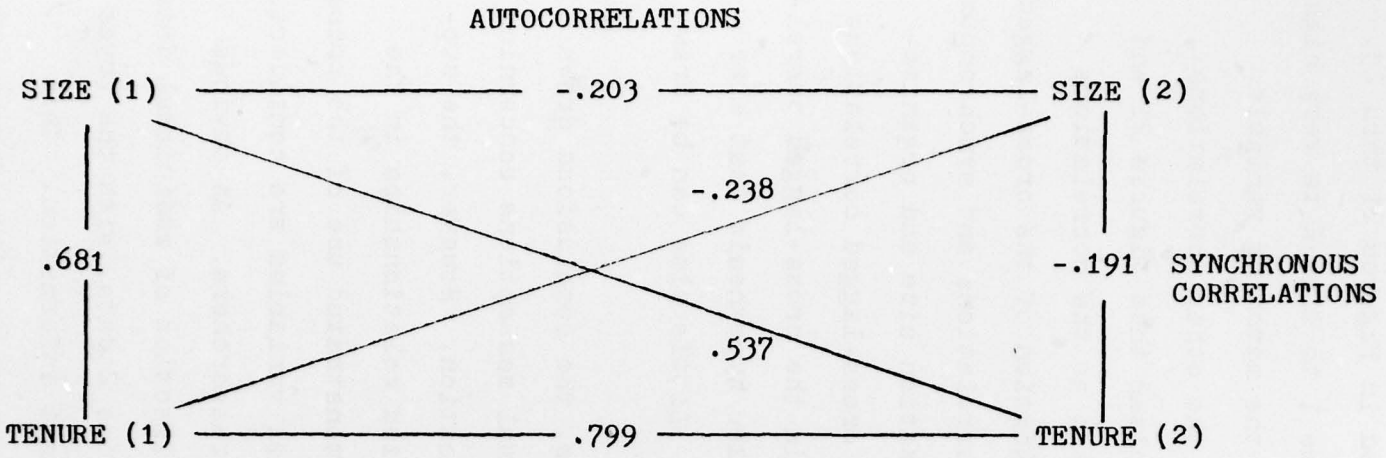


Figure 21. Cross-lagged Diagram for Organization Size and Tenure Across Phases

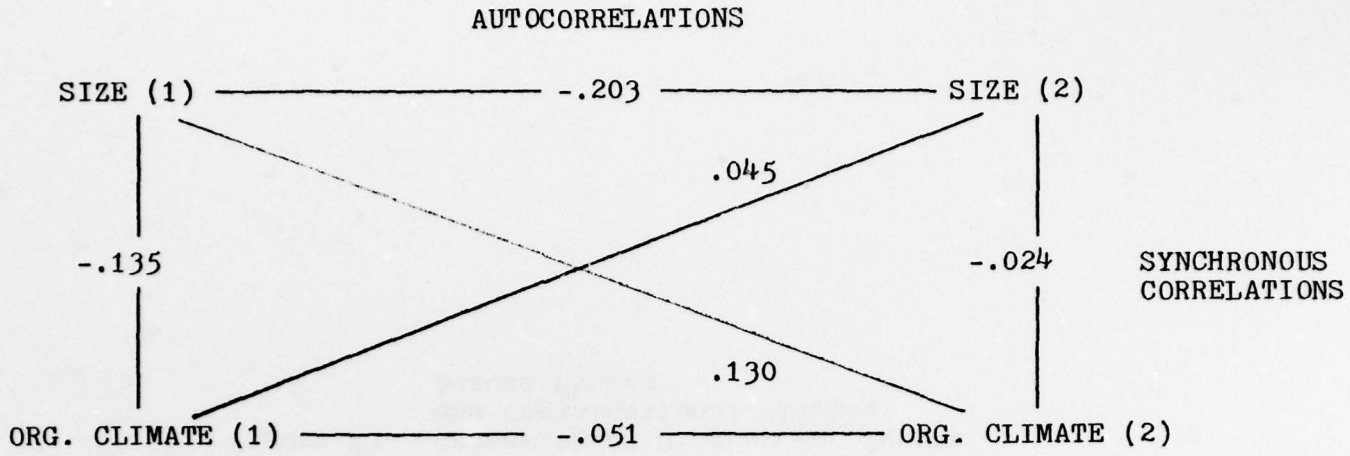


Figure 22. Cross-lagged Diagram for Organization Size and Organizational Climate Across Phases

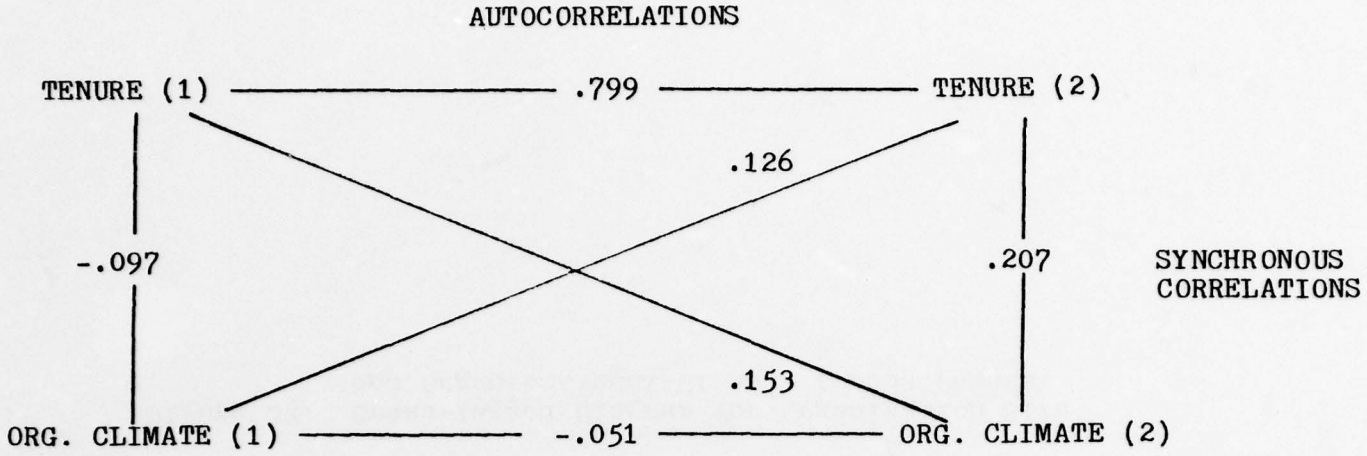


Figure 23. Cross-lagged Diagram for Tenure and Organizational Climate Across Phases

Chapter 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE STUDY

SUMMARY

The Weapons System Acquisition Process has been the subject of much study and discussion over the past several years. The reason is obvious - billions of dollars are at stake. To manage the weapon systems acquisition process the Air Force uses a concept known as program or project management. Systems Program Offices (SPO's) were created to insure quality systems were received for the expenditure of these monies.

A succession of research projects have studied the structure of SPO's in an attempt to determine how the management environment can be improved and, consequently, how productivity can be increased. A model of key organizational variables (both structural and behavioral) was suggested to aid Air Force managers in designing the structure of the SPO. The objectives of this study were to extend this effort by (1) performing a longitudinal analysis of the variables as they change throughout the acquisition process, and (2) constructing a model to explain the causal relationships among the variables. The methodology available to accomplish this was cross-lagged analysis.

The major research question this research attempted to answer was: Can the previous research efforts be integrated into an overall causal model of the life cycle of a System Program Office? This major question required the formulation of several related questions which would facilitate an answer by phases.

1. Are the data from these previous efforts sufficiently compatible to allow integration? Difficulty was encountered in attempting to answer this question to the extent that (1) the complete analysis could not be concluded, and (2) any conclusions drawn may be suspect. The cross-lagged analysis technique requires the variables to be measured at two different points in time. In addition, all variables must be measured simultaneously in each period. There were variations in the Time 1 measurements, violating the synchronicity assumption of cross-lagged analysis.

2. Is a procedure available to accomplish integration? The cross-lagged analysis technique would allow integration of prior efforts provided the data is consistent. The technique was developed for use on responses from individuals but can be adapted for use on organizational variable by averaging the responses for each variable from each organization to create single data points per organization.

3. Can a realistic or appropriate theory be developed from this model once constructed? This question cannot be completely answered in this study. Support for

certain of the hypothesized relationships among the variables was found but, because of the additional assumptions required to make the data useable, this support cannot be considered conclusive. It is interesting to note, however, that while support was found for some of the previously developed relationships, at no time was there evidence of a relationship which contradicted the hypothesized model and the findings of Noyes and Parker.

CONCLUSIONS

Once the data from the prior researchers studies had been adapted to the technique and the cross-lagged analysis had been performed, several causal relationships were identified. Specifically, role conflict directly influences role stress (as role conflict increases role stress also increases), an inverse relationship exists between tenure and organizational climate (the more tenure a program manager has the more the perceived organizational climate declines), and a direct relationship was found between organization size and organizational climate (the larger an organization is the more favorable the organizational climate is perceived to be). The results of the analysis of the other variables showed either no relationships or inconclusive results.

This study originally envisioned a much broader scope. When certain portions of the data were found to be

inappropriate for use in a cross-lagged analysis, the scope of this research was necessarily altered. While a definitive causal model was not constructed, it is the opinion of the researchers that the cross-lagged technique has definite merit in analyzing organizational variables and could develop such a model given consistent data. The results generated by this study are useful in describing and understanding the structural and behavioral dynamics of a SPO over its life cycle during the weapon system acquisition process. Certainly these results can be questioned when considering the assumptions necessary in adapting the data for use with cross-lagged analysis, but the technique was successfully demonstrated for use with organizational variables. Given data that is definitely consistent and amenable, this technique could produce the definitive causal model of structural and behavioral variables as they interact and affect the management of a SPO over its life cycle. Such a model could significantly improve an Air Force manager's ability to forsee managerial difficulties and take the necessary corrective action before irreparable damage is done.

This research deliberately concentrated on the pattern of relationships developed by the research team of Noyes and Parker (20). The decision to take this approach was made after (1) the data was examined and found to be inconsistent, (2) the scope of the entire research effort

was narrowed, and (3) the thrust of the study was more or less one of demonstrating the cross-lagged technique. It must be emphasized here that this decision to concentrate on established or hypothesized patterns was strictly one of convenience in demonstrating the technique. Once useable data is obtained, the cross-lagged technique can be used to analyze the entire universe of correlations between the selected variables. The technique can be of tremendous value not only in analyzing the Noyes and Parker model but in analyzing all other possible relationships.

RECOMMENDATIONS FOR FUTURE RESEARCH

As can be concluded from the previous discussion, the data used in any cross-lagged analysis is critical to the success of the analysis. If the reliability of the data cannot be assumed, no confidence can be placed in the results. The data collected by the Noyes and Parker team in this ongoing study of organizational variables is acceptable and appropriate, but the Time 1 data used here is not. The degree to which it violates the assumption of synchronicity can neither be measured nor corrected. This inconsistency in the data has obviously caused considerable problems.

To overcome the problems encountered in this study, additional data should be collected. The Noyes and Parker survey instrument (Appendix B) should be used to gather this

data. Recall that while Noyes and Parker used questions from the previous instruments, the combination of variables and the question sequencing used could have affected the instrument reliabilities. Use of the same survey instrument and collection of the data on all the variables at the same time would greatly enhance the success of another cross-lagged analysis attempt.

In addition to using the same instrument the same organizations used by Noyes and Parker should be used again. This will eliminate the problems encountered in this research when matching was attempted. However, if the responses are not averaged over the entire organization and treated as one organizational response there will still have to be some matching within organizations. In this case a decision must be as to what variable should be used as the common variable, as tenure was used in this study. Averaging of the responses for each organization would be the most theoretically justifiable approach and is highly recommended.

Once the data has been collected and is determined to be compatible with the Noyes and Parker data, the cross-lagged technique can be performed as described in this study. In all longitudinal analyses, the reliability of data may change with the passage of time and in turn affect the cross-lagged correlations. These reliabilities can be calculated and compared, however, to test for consistency.

Kenny has suggested a method of correcting the cross-lagged correlations for these changes in reliability (15:897, 898). Once these corrections have been made, the cross-lagged correlations can be directly examined for differences and analyzed for causal relationships.

APPENDICES

APPENDIX A

SUMMARY OF PREVIOUS RESEARCH DATA

SOURCE	SAMPLE	DATA COLLECTION	PERTINENT FINDINGS
Lempke and Mann (1976)	142 program managers (95% response) randomly drawn from 13 program officers representing 3 phases of project life cycle.	Questionnaire, personally distributed, yielded data on organizational nature of tasks, phase of life cycle, and size of organization.	Organizations are most project oriented in early phase of project life, least project oriented in middle phase of project life. Organizations are smallest in early phase, largest in middle phase.
Barndt, Larson and Ruppert (1977) and Haddox and Long (1976)	185 program managers (80% response) randomly drawn from 13 program offices representing 3 phases of project life cycle.	Questionnaire, mailed to subject, yielded data on organizational climate, satisfaction, organizational size, and phase of life cycle.	1. Significant differences in organizational climate among phases. 2. Significant differences in organizational climate among program offices of different sizes. Organizational climate is correlated with satisfaction.

NOTE: 1. Findings of the Barndt, Larson and Ruppert study.
2. Findings of the Haddox and Long study.

SOURCE	SAMPLE	DATA COLLECTION	PERTINENT FINDINGS
Eschmann and Lee (1977)	136 program managers (68% response) randomly drawn from 20 program offices representing 4 phases of project life cycle.	Questionnaire, personnally distributed, yielded data on sources of conflict, intensity of conflict, method of conflict resolution, and phase of life cycle.	Conflict intensity changed across program life cycle, Air Force program managers perceived less intensity of conflict than civilian project managers, and Air Force and civilian project managers agreed on conflict resolution modes across life cycle phase.
Noyes and Parker (1978)	145 Program managers (77% response) randomly drawn from 12 program offices representing 4 phases of project life cycle.	Questionnaire, personally distributed, yielded data on tenure, level of bureaucracy, role stress, role conflict, role ambiguity, organizational climate, conflict intensity, and organizational size.	As organizational climate improves, levels of role conflict, role ambiguity and role stress decrease. Structural variables have a significant effect on behavioral outcomes.

APPENDIX B

SURVEY INSTRUMENT

SURVEY OF PROGRAM MANAGEMENT

1. This survey of Program Management perceptions will provide data for use in an Air Force Institute of Technology student thesis project. The questionnaire is divided into five parts and will take approximately 20 minutes to complete.

   (a) Part one consists of general duty information.

   (b) Part two contains questions that ask you to describe your primary duties.

   (c) Part three contains questions that ask you to indicate your feelings about your job.

   (d) Part four contains questions that ask you to provide your opinion about certain characteristics of your organization.

   (e) Part five contains one question that asks you to indicate, for seven different sources of conflict, the amount of conflict in your organization.

2. The questionnaire is not intended to assess organization or individual performance. All responses will be held in the strictest confidence. Individuals or SPO organizations will not be associated with any of the data.

3. There are no "trick" questions. Please answer each item as honestly and frankly as possible. There are no right or wrong answers. The important thing is that you answer each question the way you see things or the way you feel about them.

4. Your cooperation and assistance in completing this questionnaire will be appreciated.

This survey is to be used for research purposes only. It is not to be used without the permission of the School of Systems and Logistics and/or the authors.

PART I

GENERAL DUTY INFORMATION

PLEASE PRINT

DUTY ORGANIZATION (SPO) _____

MILITARY RANK OR CIVILIAN GRADE _____

JOB TENURE:

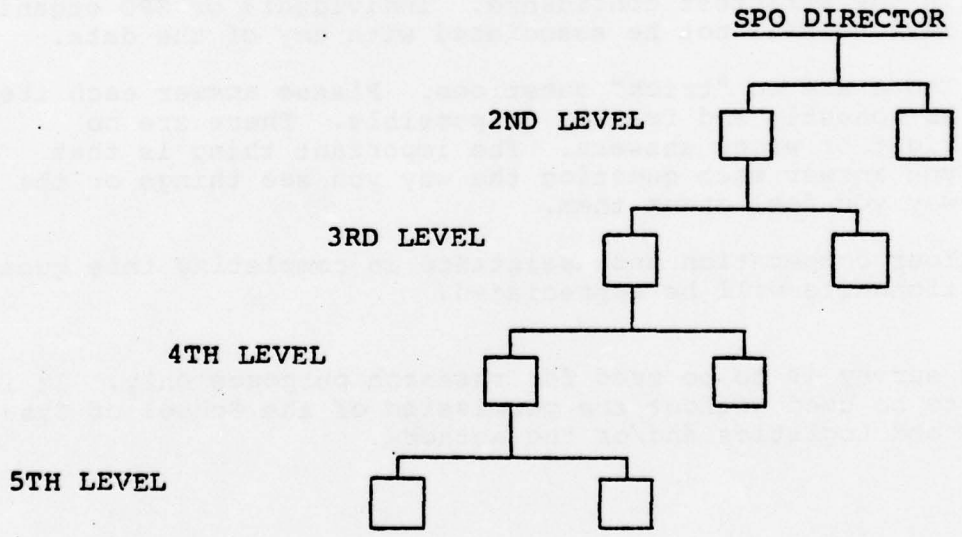
NUMBER OF MONTHS IN PRESENT POSITION: _____MOS.

NUMBER OF MONTHS ASSIGNED TO PRESENT SPO: _____MOS.

LENGTH OF TIME YOU HAVE WORKED WITH THE USAF:
_____ YEARS AND _____ MOS.

WAS THERE A PERIOD OF JOB OVERLAP BETWEEN YOU AND THE LAST JOB INCUMBENT WHEN YOU ASSUMED YOUR PRESENT POSITION (YES/NO)? _____
IF SO, HOW MUCH _____ MOS.

ORGANIZATIONAL LEVEL. PLEASE PLACE A CHECKMARK IN THE BOX IN THE FOLLOWING ORGANIZATIONAL CHART THAT BEST CORRESPONDS TO THE LEVEL OF YOUR DUTY ASSIGNMENT.



PART II

THIS PART OF THE QUESTIONNAIRE ASKS YOU TO DESCRIBE HOW YOU CARRY OUT YOUR PRIMARY DUTIES.

Please put a checkmark in the box which is the most accurate description of your primary duties. The job descriptions presented represent the outermost boxes. The five intermediate boxes represent degrees of "inbetweenness" of the descriptions.

---

1. To what extent do you work outside of the chain-of-command of your organization to discharge your primary duties?

I can discharge all my primary duties by working strictly within the chain-of-command.

My primary duties require frequent use of horizontal and diagonal contacts that are outside of my specific chain-of-command.

2. To what extent do your primary duties require you to coordinate activities through a common supervisor who directly controls the activities of most groups contributing to the overall goal of your organization?

I only coordinate activities with my supervisor who has responsibility for a group of activities having the same overall goal.

My primary duties require me to personally coordinate activities across functional and organizational lines to accomplish an overall organizational goal.

3. To what extent do you determine how the objective of your job will be accomplished?

Specific procedures dictate exactly what I am supposed to do.

I am allowed to determine the best way to accomplish the objectives of my job.

4. To what extent do you accomplish your primary duties by dealing with people outside of your immediate working unit (branch, section, etc.)?

I work only with people within my working unit.

I work with people outside of my working unit frequently.

5. To what extent can you rely on previously developed methods of procedures to accomplish your primary duties?

My primary duties are generally repetitive, routine, and proceduralized.

I must search for new methods and ideas in order to accomplish each duty. They vary so much that they cannot be proceduralized.

6. To what extent do you deal with groups outside of the strict chain-of-command in order to accomplish your primary tasks?

I accomplish all my primary duties by working solely with my supervisor and my subordinates.

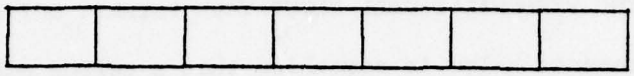
My working contacts vary in the accomplishment of my primary duties; therefore, I frequently work with groups that are outside the strict chain-of-command.

7. To what extent is your authority commensurate with your responsibilities?

I have complete authority to accomplish my primary duties for which I am held responsible; i.e., authority equals responsibility.

My authority for the accomplishment of my primary duties for which I am held responsible is incomplete; i.e., responsibilities exceed authority.

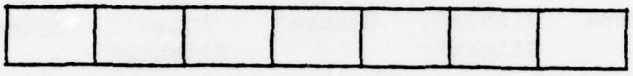
8. To what extent are you allowed to obtain and use resources (material, money, time) from outside of your chain-of-command to accomplish your primary duties?



I use only those resources provided through the formal chain-of-command.

I obtain and use resources from outside the chain-of-command in order to accomplish my primary duties.

9. To what extent do the primary duties that you are involved with support more than one organization's objectives?



My primary duties involve only the direct support of my SPO's objectives.

My primary duties involve a joint venture supported by many relatively independent organizations.

PART III

THIS PART OF THE QUESTIONNAIRE ASKS YOU TO INDICATE HOW YOU PERSONALLY FEEL ABOUT YOUR PRIMARY DUTIES.

Each of the statements below is something that a person might say about his or her job. Please indicate your own, personal feelings about your job by marking how much you agree or disagree with each of the statements.

Write a number in the blank for each statement, based on this scale:

How much do you agree with the statement?

1	2	3	4	5	6	7
Disagree Strongly	Disagree	Disagree Slightly	Neutral	Agree Slightly	Agree	Agree Strongly

___ 1. I have enough time to complete my work.

___ 2. I feel certain about how much authority I have.

___ 3. I perform tasks that are too easy or boring.

___ 4. There are clear, planned goals and objectives for my job.

___ 5. I have to do things that should be done differently.

___ 6. There are a lack of policies and guidelines to help me.

___ 7. I am able to act the same regardless of the group I am with.

___ 8. I am corrected or rewarded when I really don't expect it.

___ 9. I work under imcompatible policies and guidelines.

___10. I know when I have divided my time properly.

___11. I receive my assignment without the manpower to complete it.

___12. I know what my responsibilities are.

___13. I have to buck a rule or policy in order to carry out an assignment.

1	2	3	4	5	6	7
Disagree Strongly	Disagree	Disagree Slightly	Neutral	Agree Slightly	Agree	Agree Strongly

1	2	3	4	5	6	7
Disagree Strongly	Disagree	Disagree Slightly	Neutral	Agree Slightly	Agree	Agree Strongly

___14. I have to "feel my way" in performing my duties.

___15. I receive assignments that are within my training and capability.

___16. I feel certain how I will be evaluated for a raise or promotion.

___17. I have the right amount of work to do.

___18. I am unsure on how to divide my time.

___19. I work with two or more groups who operate quite differently.

___20. I know exactly what is expected of me.

___21. I receive incompatible requests from two or more people.

___22. I am uncertain as to how my job in linked.

___23. I do things that are apt to be accepted by one person and not accepted by other.

___24. I am told how well I am doing my job.

___25. I receive an assignment without adequate resources and material to execute it.

___26. Explanation is clear of what has to be done.

___27. I work on unnecessary things.

___28. I have to work under vague directives or orders.

___29. I perform work that suits my values.

___30. I do not know if my work will be adequate to my boss.

1	2	3	4	5	6	7
Disagree Strongly	Disagree	Disagree Slightly	Neutral	Agree Slightly	Agree	Agree Strongly

PART IV

THIS PART OF THE QUESTIONNAIRE ASKS YOU TO PROVIDE YOUR OPINION ABOUT CHARACTERISTICS OF YOUR ORGANIZATION.

On the line below each organizational variable (item), please place an X at the point which, in your experience, describes your organization at the present time. Treat each item as a continuous variable from the extreme at one end to that at the other.

1. How much confidence and trust is shown in subordinates?

Virtually none	Some	Substantial Amount	A great deal

2. How free do they feel to talk to superiors about job?

Not very free	Somewhat free	Quite free	Very free

3. How often are subordinate's ideas sought and used constructively?

Seldom	Sometimes	Often	Very frequently

4. Is predominant use made of 1. fear, 2. threats, 3. punishment, 4. rewards, 5. involvement?

1, 2, 3, occasionally 4	4, some 3	4 some 3, and 5	5, 4, based on group-set goals

5. Where is responsibility felt for achieving organization's goals?

Mostly at top	Top and middle	Fairly general	At all levels

6. How much cooperative teamwork exists?

Very little	Relatively little	Moderate Amount	Great deal

7. What is the usual direction of information flow?

Downward	Mostly downward	Down and up	Down, up and sideways

8. How is downward communication accepted?

With suspicion	Possibly with suspicion	With caution	With a receptive mind

9. How accurate is upward communication?

Usually inaccurate	Often Inaccurate	Often accurate	Almost always accurate

10. How well do superiors know problems faced by subordinates?

Not very well	Rather well	Quite well	Very well

11. At what level are decisions made?

Mostly at top	Policy at top, some delegation	Broad policy at top, more delegation	Throughout but well integrated

12. Are subordinates involved in decisions related to their work?

Almost never	Occasionally consulted	Generally consulted	Fully involved

13. What does decision-making process contribute to motivation?

Not very much	Relatively little	Some contribution	Substantial contribution

14. How are organizational goals established?

Orders issued	Orders, some comments invited	After discussion by orders	By group action (except in crisis)

15. How much covert resistance to goals is present?

Strong resistance	Moderate resistance	Some resistance at times	Little or None

16. How concentrated are review and control functions?

Very highly at top	Quite highly at top	Moderate delegation to lower levels	Widely shared

17. Is there an informal organization resisting the formal one?

Yes	Usually	Sometimes	No--same goals as formal

18. What are cost, productivity, and other control data used for?

Policing, punishment	Reward and punishment	Reward, some self-guidance	Self-guidance problem-solving

PART V

THIS PART OF THE QUESTIONNAIRE ASKS YOU TO INDICATE THE AMOUNT OF CONFLICT IN YOUR ORGANIZATION.

Please read the definitions of the seven potential conflict sources. Then, on the line beside each category of conflict (item), place an X at the point which, in your experience, describes the degree of conflict in your organization at the present time. Treat each item as a continuous variable from the extreme at one end to that at the other.

Conflict over:	1 Virtually none	2 Some	3 Substantial amount	4 A great deal
A. Program Priorities	1	2	3	4
B. Administrative Procedures	1	2	3	4
C. Technical Issues	1	2	3	4
D. Manpower Resources	1	2	3	4
E. Cost Objectives	1	2	3	4
F. Schedules	1	2	3	4
G. Personality	1	2	3	4
	1 Virtually none	2 Some	3 Substantial amount	4 A great deal

Definitions for Question

7 POTENTIAL CONFLICT SOURCES

CONFLICT OVER PROGRAM PRIORITIES. The views of program participants often differ over the sequence of activities and tasks which should be undertaken to achieve successful program completion. Conflict over priorities may occur not only between the SPO and other support groups, but also within the SPO itself.

CONFLICT OVER ADMINISTRATIVE PROCEDURES. A number of managerial and administrative-oriented conflicts may develop over how the program will be managed; i.e., the definition of the program manager's reporting relationships, operational requirement, scope, definition of responsibilities, interface relationships, negotiated work agreements with other groups, and procedures for administrative support.

CONFLICT OVER TECHNICAL OPINIONS AND PERFORMANCE TRADEOFFS. Disagreements may arise over technical issues, performance specifications, technical tradeoffs, and the means to achieve technical performance.

CONFLICT OVER MANPOWER RESOURCES. Conflicts may arise around the staffing of the program with personnel from other functional and staff support areas or from the desire to use another department's personnel for program support even though the personnel remain under the authority of their functional superiors.

CONFLICT OVER COST. Conflict may develop over cost estimates from support areas regarding various program work breakdown packages.

CONFLICT OVER SCHEDULES. Disagreements may develop around the timing, sequencing, and scheduling of project related tasks.

PERSONALITY CONFLICT. Disagreements may tend to center on interpersonal differences rather than on "technical issues." Conflicts are often "ego-centered."

APPENDIX C

RAW DATA

QUESTIONNAIRE RAW DATA

Information on each variable at each time period is arranged on each line. The value for each variable is contained in four spaces (including the decimal point, if appropriate). Three files are used - Phase I, Phase III, and the data across all phases. Phases I and III contain data on all the variables while the data across all phases is only on three variables (size, tenure, and climate). The following example illustrates the format used.

A	B	C	D	E	F	G	H	I	J	K	L
010	0068	0011	0330	5.44	2.93	2.47	2.70	2.19	0066	0014	0573

M	N	O	P	Q
6.33	3.07	2.73	2.90	25.3

ITEM	VARIABLE NAME/LABEL	TIME
A.	IMPUT LINE NUMBER	
B.	ORGANIZATION SIZE	1
C.	TENURE	1
D.	ORGANIZATIONAL CLIMATE	1
E.	LEVEL OF BUREAUCRACY	1
F.	ROLE CONFLICT	1
G.	ROLE AMBIGUITY	1
H.	ROLE STRESS	1
I.	CONFLICT INTENSITY	1
J.	ORGANIZATION SIZE	2
K.	TENURE	2
L.	ORGANIZATIONAL CLIMATE	2
M.	LEVEL OF BUREAUCRACY	2
N.	ROLE CONFLICT	2
O.	ROLE AMBIGUITY	2
P.	ROLE STRESS	2
Q.	CONFLICT INTENSITY	2

PHASE I DATA

```
010 00110004054 34.563.002.732.87    0014000205234.563.803.073.4416.9
020 0011000706255.334.075.004.53     0014000902565.565.805.205.5023.1
030 0011000905375.444.533.403.9713.000140014049 73.674.073.533.8018.6
040 0011000905815.004.274.804.5314.900140024030 34.563.803.803.8021.4
050 0011001105455.333.603.533.5712.900140024035 75.444.473.874.1722.0
060 0011001805996.223.273.333.30     0014002405476.334.003.003.5017.1
070 0011003605485.223.474.003.7321.700140036021 36.005.874.875.3715.7
080 0018000606374.223.403.473.4311.900170005061 45.672.401.401.9020.0
090 0018000705215.113.804.534.17     0017000804985.444.274.074.1720.0
100 0018001005284.893.873.933.90     0017001206044.002.332.272.3015.7
110 0018001105886.004.803.734.27     0017002003382.894.474.674.5717.4
120 0018001205433.003.733.003.37     0017002504044.894.675.274.9722.9
130 0018001206035.002.803.203.00     0024001005314.893.472.405.8719.3
140 0018001305896.333.935.004.47     0024001105405.332.272.402.3414.3
150 0018001306254.783.472.002.74     0024001203233.784.675.675.1725.1
160 0018001405955.005.333.074.20     0024001204444.893.533.603.5718.6
170 0018001403895.332.472.932.70     0024001403604.784.133.803.9723.9
180 0018001505465.113.673.333.5018.300240014051 13.783.733.933.3317.1
190 0018001505835.334.133.934.0314.000240023055 55.563.001.932.4717.9
200 0018001505014.782.532.732.6324.100240024035 55.894.333.273.8030.0
210 0018001505875.893.273.603.43     0024003005665.223.272.472.8718.6
220 0018004303015.443.803.933.8716.900240042042 24.334.203.733.9727.1
```

PHASE III DATA

```
010 0068001103305.442.932.472.7021.90066001405736.333.072.732.9025.3
020 0068001305025.784.734.474.6020.70066001704345.674.804.734.7720.0
030 0068001504454.894.072.073.0718.60066002103654.113.403.403.4022.9
040 0068002805315.003.872.533.20    0066002204105.003.873.203.5420.0
050 0068003003325.894.204.004.1011.30066002204795.224.474.274.3725.7
060 0068004005715.563.272.272.77    0066002204904.673.333.473.4015.6
070 0068009604464.224.202.873.5416.70066002302904.674.274.334.3024.3
080 0087000705695.443.472.603.04    0066002804995.113.333.403.3717.7
090 0087001004085.563.273.273.2713.30066003505054.673.132.602.8715.7
100 0087001803853.443.404.203.8010.60066003603896.783.605.004.3017.1
110 0087002003044.565.604.875.2414.70066004801924.562.802.002.4017.9
120 0087002004676.333.003.873.4416.10066005101973.894.275.204.7423.7
130 0087003604955.223.802.132.9716.70066006003284.784.332.733.5320.3
140 0105000405465.782.132.402.27    0108000304934.893.603.333.4718.6
150 0105000605864.895.134.935.0311.10108000605554.674.273.402.8420.9
160 0105001805044.894.733.203.9715.60108001906685.442.472.072.2714.3
170 0105002304755.223.932.873.40    0108002404794.223.273.733.5014.1
180 0105003003336.114.473.203.8410.30108003105374.784.273.874.0824.9
190 0105003505213.442.272.602.4414.30108003604064.784.204.004.1019.3
200 0105004304424.894.274.404.3418.70108004805455.443.932.733.3317.1
```

ALL PHASES DATA

```
10 007000020309013400020450
20 007000040611013400080311
30 007000060402013400090387
40 007000060436013400090532
50 007000060530013400100335
60 007000070528013400100472
70 007000090532013400100500
80 007000100417013400100508
90 007000110504013400110425
100 007000120356013400130414
110 007000130482013400130555
120 007000140569013400140386
130 007000160465013400160516
140 007000230551013400230487
150 007000240586013400240290
160 007000450553013400430569
170 016900130434006600140573
180 016900160577006600170434
190 016900210357006600210365
200 016900220535006600220410
210 016900230305006600220479
220 016900230395006600220490
230 016900240491006600230290
240 016900280583006600280499
250 016900340372006600350505
260 016900350531006600360389
270 016900400394006600480192
280 016900500380006600510197
290 016900620382006600600328
300 020700040571010800030493
310 020700060494010800060555
320 020700160543010800150504
330 020700190626010800190668
340 020700220582010800210493
350 020700240423010800210617
360 020700240573010800240469
370 020700240585010800240479
380 020700270531010800280601
390 020700270553010800310537
400 020700270619010800330463
410 020700270634010800340416
420 020700360495010800360406
430 020700460516010800480545
440 020700600564010800580432
450 001800060637007900040505
460 001800070521007900070470
470 001800150501007900160555
480 001800150546007900230565
490 001100070625001500100503
500 001100090537001500100515
510 001100090581001500110449
520 001100110545001500170437
530 001100180599001500180491
540 001100360548001500420522
550 016800090541001800060652
560 016800100391001800090386
570 016800120541001800090392
580 016800180321001800200346
590 016800240483001800220173
600 016800240587001800230487
610 016800250536001000250380
620 016800260527001000260352
630 016800340450000100320413
640 016800360431001000400659
650 016800550472001000580381
```

APPENDIX D

SPSS COMPUTER PROGRAMS

The computer programs on the following pages were used to acquire the correlation coefficients used in the analysis. The programs are basically the same except for the data files used. The program provides pairwise correlation coefficients on all variables.

PHASE I PROGRAM

```
1Ø##S,R(SL) :,8,16;;,16
2Ø$:IDENT:WP11Ø8,AFIT/LSG D MALONEY 79A 56513
3Ø$:SELECT:SPSS/SPSS
4ØRUN NAME;CROSS-LAGGED ANALYSIS PHASE I
5ØVARIABLE LIST;SIZE1,TENU1,CLIM1,LEVB1,CONF1,AMBIG1,STRES1,INTNS1,
55;SIZE2,TENU2,CLIM2,LEVB2,CONF2,AMBIG2,STRES2,INTNS2
6ØINPUT FORMAT;FIXED (F4.Ø,F4.Ø,F4.Ø,F4.2,F4.2,F4.2,F4.2,F4.1,
65;F4.Ø,F4.Ø,F4.Ø,F4.2,F4.2,F4.2,F4.2,F4.1)
7ØINPUT MEDIUM;CARD
8ØN OF CASES;22
85MISSING VALUES;ALL (Ø)
11ØPEARSON CORR;SIZE1 TO INTNS2 WITH SIZE1 TO INTNS2
12ØOPTIONS;3
125READ INPUT DATA
13Ø$:SELECTA:ONE.1
14ØFINISH
15Ø$:ENDJOB
```

PHASE III PROGRAM

```
10##S,R(SL) :,8,16;;,16
20$:IDENT:WP1108,AFIT/LSG D MALONEY 79A 56513
30$:SELECT:SPSS/SPSS
40RUN NAME;CROSS-LAGGED ANALYSIS PHASE III
50VARIABLE LIST;SIZE1,TENU1,CLIM1,LEVB1,CONF1,AMBIG1,STRES1,INTNS1,
55;SIZE2,TENU2,CLIM2,LEVB2,CONF2,AMBIG2,STRES2,INTNS2
60INPUT FORMAT;FIXED (F4.0,F4.0,F4.0,F4.2,F4.2,F4.2,F4.2,F4.1,
65;F4.0,F4.0,F4.0,F4.2,F4.2,F4.2,F4.2,F4.1)
70INPUT MEDIUM;CARD
80N OF CASES;20
85MISSING VALUES;ALL (0)
110PEARSON CORR;SIZE1 TO INTNS2 WITH SIZE1 TO INTNS2
120OPTIONS:3
125READ INPUT DATA
130$:SELECTA:THREE.1
140FINISH
150$:ENDJOB
```

ALL PHASES PROGRAM

```
10##S,R(SL) :,8,16;;,16
20$:IDENT:WP1108,AFIT/LSG D MALONEY 79A 56513
30$:SELECT:SPSS/SPSS
40RUN NAME;CROSS-LAGGED ANALYSIS ALL PHASES
50VARIABLE LIST;SIZE1,TENU1,CLIM1,SIZE2,TENU2,CLIM2
60INPUT FORMAT;FIXED (F4.0,F4.0,F4.0,F4.0,F4.0,F4.0)
70INPUT MEDIUM;CARD
80N OF CASES;65
110PEARSON CORR;SIZE1 TO CLIM2 WITH SIZE1 TO CLIM2
120OPTIONS;3
125READ INPUT DATA
130$:SELECTA:NEW
140FINISH
150$:ENDJOB
```

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BIOGRAPHICAL SKETCHES

Major Daniel V. Connors graduated from State College at Boston in 1966 with a B.S. degree in education. He enlisted in the Air Force in August 1966 and completed Officer Training School in March 1967. His previous assignments were as an Administrative Officer at Otis AFB, Massachusetts; one year education assignment to Texas A&M University to cross train into the Meteorology career field; Weather Forecaster at Shaw AFB, South Carolina; Chief Weather Forecaster at Utapao RTNAB, Thailand; and Operations Plans Officer at 2 Weather Wing Hq, Ramstein AB, Germany. His next assignment will be to attend the Aircraft Maintenance Officers Course at Chanute AFB, Illinois.

Captain Dennis M. Maloney graduated from the University of Nebraska at Omaha in 1970 with a degree in Business Administration. He was commissioned in the Air Force in January 1971 after serving nearly 12 years in the enlisted force. After completing the Avionics Officer Course in July 1971 he was assigned as the Avionics Section Chief at Altus AFB, Oklahoma. His next assignment prior to attending the Graduate School of Systems and Logistics was as the Avionics Maintenance Supervisor at Ellsworth AFB, South Dakota. Upon leaving AFIT Captain Maloney will be assigned to the Air Force Logistics Command in the Acquisition Logistics Division.